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REGULARS

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APC

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APC delivers its monthly package of micronews.

Live from Las Vegas . . .

Comdex has become the biggest computer show in the world. It started out five years ago as a place for people who build small systems to meet people who would like to sell them. It is still that, despite the fact that the 'small' systems on show this year included small IBM and DEC mainframes. And it has to be said that the shows which the establishment knows, like the Hanover Fair, still attract the big names. But this is mere ignorance. Comdex has only been really big for two years, and the power of the big retail chains has still not dawned on many established computer companies. So they still don't come.

Earlier this year, at the National Computing Conference in Anaheim, the place was thick with journalists.

There was barely anything of note to report – and what there was had been announced a couple of weeks previously. That is, it had appeared at Comdex Spring.

Here in Las Vegas, where I am writing this report in a Sunset Strip hotel, there are nearly 100,000 delegates from all over America, looking at the market for business micros.

What follows is a brief look at some of the more interesting presentations at Comdex.

Guy Kewney

Natural language

The arrival of a 'natural language' option for Microrim's R:Base database could make data storage systems usable by casual operators.

The product is needed. It is easy for an expert driver to park a car: impossible for a beginner.

Similarly, a beginner finds it practically impossible to formulate questions for a database.

The information is all in there, and only two or three, simple queries will set the program to work, digging out the name or list of numbers or summary of expenses that you want.

But if the information is stored under 'title' and you ask for 'names' then you will get nowhere for a long time.

What Microrim's Clio aims to do, is to learn (by asking the user questions) what the enquirer has in mind. It uses 'expert systems' techniques to do this.

'Clio enables the user to query the database in his own language, rather than in "computerese",' said Wayne Erickson, who is president of Microrim.

The way the company publicity sheet put it: 'Clio allows the user to build a dictionary of synonyms for words or operations associated with a database.'

This dictionary building process is invoked whenever the user queries the database with a word or series of words not already in the database vocabulary.

Clio 'then responds with a series of questions to the user, to define the unfamiliar terms. Through this conversation, "the statement continues," new words are built into the database vocabulary.'

Clio also has the ability to search through the database to retrieve records based on adjectives, or other qualifiers.

'Where Clio becomes even more valuable,' Erickson claims, 'is when the user wants to define a word which is not related to something in the database. It allows the user to define words which are the result of computation.'

An example quoted by Erickson: if you ask for profit for a particular period, and profits not actually entered into the database.

'The user would define profit as "sales minus expenses" where both sales and expenses are listed in separate parts of the database, to come up with the answers.'

Next step from Microrim is nothing if not ambitious: after adding graphics, Erickson wants to see Clio become 'the user's interface to the computer.'

What users of the future need to get them involved in computers is a system which has enough sense to work out what it is meant to do ahead of time.

There are many parts to this, but a vital one is the ability to see that the command D and the command Delete might be the same, while the command DI might be either 'directory' or 'display'.

Current systems which will accept single letter commands will reject two-letter commands starting with the same letter as unknown.

And it is quite clear that Gary Kildall of Digital Research has never quite grasped how many enemies his bureaucratic operating system, CP/M, has made.

I will always think of CP/M as the sort of clerk who makes you fill out the form in triplicate, without carbon, and only when you have finished points out that the date is wrong on the top of the first page. And then he won't let you rub it out, but makes you fill out the whole form again.

Clio costs under $200. The R:Base it reads costs $495.

Details from Microrim on (206) 453 6017 in Bellevue, Washington (nice and handy for Microsoft).

Guy Kewney

Popular portables

Portable computers, a novelty two years ago, are now attracting serious research and development money, producing the 16-line, 80-column liquid crystal screen.

Everybody at Comdex seemed to have one. They ranged from nearly complete prototypes to nearly available systems.

The surprising thing was that some people with these ultra low-power screens didn't have them fitted to low-power computers.

Visual Computer's Commuter, for example, looks very like the Gavilan which is a battery-powered portable.

But the Commuter turned out to have standard dual IBM-standard disk drives, and needed a proper mains power supply. This seemed a bit strange: with power available from the mains, there are compact flat screens which give much better visibility and much more detail than liquid crystal technology.

Both Gavilan and Sharp had caught on to the low power benefits of the big screen, and both had upgraded their eight-line displays to 16-line size.

Gavilan's is by far the more sophisticated and exciting design, apart from its 'mouse' pointing pad.

First of all, it has an 'integrated software environment' which means that programs run hand in hand with each other, as on the Lisa.

The machine includes a single Sony 3.5 in micro-diskette, is battery powered, and the $4000 price includes three applications modules – text editor, spreadsheet, and comms.

The original Gavilan is now a cut-down version, at a reduced $3000 price, without the software, without the built-in modem and without Basic and Pascal.

Both machines do acknowledge the need for a bigger display (something none of its rivals will stop to) by having a video output for a monochrome monitor, giving a full computer page. And both include MX-DOS as the operating system.

Guy Kewney

The Teleram range of 16-line LCD micros: the T-5000 8-bit machine costs $2500 and uses the Zilog Z80L and CP/M-80.

The STM portable personal computer weighs less than 17lb and includes 256k of RAM (expandable to 512k).

The Chameleon micro, weighing 28lb, is marketed by Seequa as a low-cost IBM running 8-bit CP/M software.

In June, when first demonstration units appeared, they were 'don't touch' machines: at Comdex, the Gavilans were freely available for finger-poking.

And software from outside vendors is available: WordStar, SuperCalc 2, PFS (personal filing system) Report, PFS File and Acculink are available now, and EasyWriter, Multiplan, SuperWriter, SuperComm, SuperPlanner, SuperTool and Business Manager are planned for mid-year.

Weight of the Gavilan is nine pounds: an optional printer can be carried together or separately. And first production models are expected any day now.

The Sharp is the same model that appeared in the December issue of APC, and it uses bubble electronics, rather than diskettes, as its extension storage.

But though bubbles do give more storage, they can't be plugged into the computer the way disks can, so for a lot of potential users the lower price of the Sharp will be seen as a true measure of its quality.

The big LCD also appeared on a machine which looks so much like the Archives PC that at first sight it looked like STM Electronics had copied the thing. It turns out that it is the Archives PC's big brother, with MS-DOS, an IBM compatible disk, but a much faster 80186 processor inside than the IBM's 8088.

This machine (like so many American computers, like so few Australian computers) includes a direct-connect phone interface – an auto-dial, auto-answer modem, which can switch from slow 300 baud to faster 1200 baud standards.

Cost of the STM is $3000, and a desk-top version at $2500 will also be released when the final design becomes available in April.

The last of the 16-line LCD machines was shown by Teleram, which had another bubble-based machine, the T-5000, at $2500.

Unlike the other portables, this one is an 8-bit design, using the Zilog Z80L and CP/M-80.

What makes the Teleram special is the fact that it can be used as a keyboard for the T-3500 desk-top computer, with lots of ordinary CP/M disk-based features (such as the ability to format Osborne single-density diskettes, or IBM CP/M-86 format diskettes) and software.

Another portable which attracted attention last year, the Corona, is now turning up for test with an interesting new feature – no carrying handle. This, given its impressive weight, was no bad thing. It may be more compact than an ordinary multi-unit desk-top computer, but not much smaller.

Texas Instruments also weighed in (ho! ho!) with a 33lb colour Professional portable. It is entirely compatible with the ordinary Professional.

Somewhat easier to carry (28lb), the Chameleon from Seequa, launched a year ago, is now distributed through some 300 US outlets as a low-cost IBM with a difference – it can run 8-bit CP/M software, too.

Like the DEC Rainbow, the Chameleon has a Zilog Z80 chip inside it, as well as a 16-bit 8088.

The base price of the Seequa range is $2000, which is pretty competitive, except for the fact that it buys a single-disk, no-screen box. Software available is mainly Perfect Software's range, plus the Condor database manager.

Price details were not available on the new hard disk system, just launched at Comdex, but Seequa promises to be 'aggressive'.

However, the US press appears not to have been totally smitten with the design, since it varies fairly radically from the IBM PC design, and compatibility is not its main feature.

Teleram is in New York on (914) 694 9270. Gavilan is on the US West Coast on (408) 379 8000. Chameleon is on (301) 672 3600. Visual is on (617) 480 0000. STM is in Menlo Park, on (415) 326 6226.

Guy Kewney

Inside: Int

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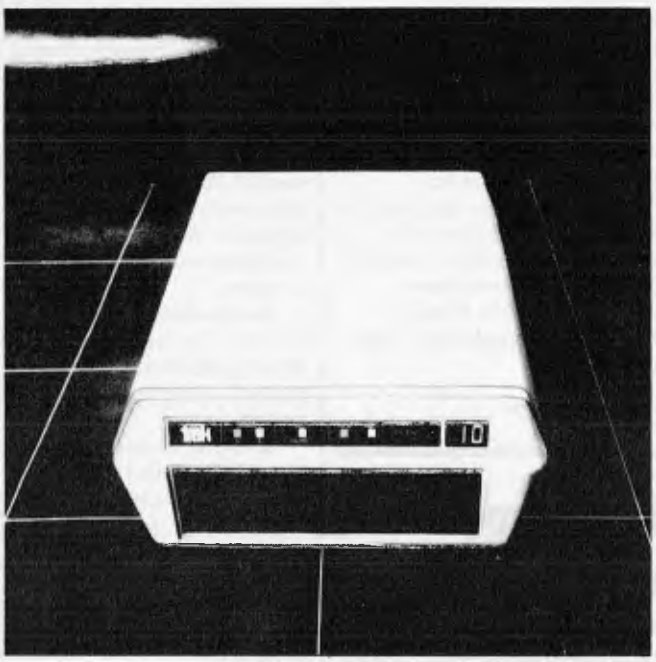

Not many people use Atari computers for business, and Comdex was definitely a business show. So, I stopped short at the sight of an Atari on the Trak minicomputers stand.

Trak was selling an add-on diskette which (it said) had enough processing power to do lots of things that ordinary Atari diskette drives cannot do.

What struck me, however, was less disk-based: the thing has a deluxe version that includes a parallel interface, 'so you can plug your favourite parallel printer directly into the back of your disk drive – you do not need to buy an expensive interface module from Atari, a saving of at least $200!'

Trak is in Illinois on (312) 968 1716.

Window on the world

It has finally dawned on computer and software designers that Apple wasn't just tying pretty ribbons on Lisa when those windows were built in. They work. And everybody is now rushing to do the same thing.

At Comdex the windows were all there, and everybody was in agreement that it was 'The Right Thing To Do'.

Where the offerings differed, however, was on what you would see through the windows.

As usual, the world is divided into two. There are those who say that people want to run their existing programs under windows – and to run more than one program in the same machine, you need a sophisticated supervisor.

And on the other side, there are those who say that this isn't enough. They say that several large, complex programs will get in each other's way, and that you must, rather, re-write the programs in such a way that they fit together well.

Digital Research's Concurrent CP/M and Quarterdeck's DesQ are the two main 'run it as it is' programs. VisiOn and MS Windows are the main protagonists of the 'slice them up smaller' approach.

MS Windows, however, does propose to allow the option of running existing applications, but Microsoft people stress that this will be less than optimum.

There were others, glimpsed in passing, showing only enough to make it clear that they were working on the same lines, and that nobody has to make their minds up yet.

This column is not the place to attempt the absurd prank of a serious comparison: let somebody else make a fool of himself trying to compare the relative weights of fire and air.

What can be said is that MS Windows does not exist. When asked why so many people had joined in announcing 'support' for MS Windows, but IBM had not, Bill Gates, Microsoft's chairman of the company, cheerfully retorted: '...because IBM doesn't pre-announce products. But we can. We won't have to wait until the end of April, and if IBM is going to announce support for windows, IBM would not announce it until then.'

It seems that even Concurrent CP/M, although the

company was able to demonstrate software running in all four windows, is not yet entirely foolproof. The evidence is the release of a new version of WordStar, the best-known text processing program, in a version for Concurrent CP/M.

Quarterdeck, like Digital Research with Concurrent CP/M, reckons that the users of DesQ will not want to run only one program at a time, and that while there may be an 'active' window, and other 'hidden' windows, the active window is not the only one where something is happening.

MS Windows, however, firmly aims to have no concurrency. Yet.

Interestingly, MS Windows has one thing going for it which couldn't have been easily foreseen. It is a 'standard' microcomputer product which ordinary computer companies like Honeywell can adopt (Honeywell demonstrated MS Windows at Comdex) without swallowing their pride. They do not have to follow IBM, which hasn't announced 'windows'. And they do not have to use CP/M, which they all denounced as a silly microcomputer thing in the days before there were many micros.

VisiOn, since it requires Visicorp to re-knit the applications, is restricted in the number of programs it has. Not theoretically (the company says) but simply in terms of what programs they have so far got around to re-knitting.

The average Australian computer user is likely to meet windows first in an Apple Lisa tutorial session in a version of Concurrent CP/M supplied for the ACT Apricot.

All the rest will come when they are ready.

That, I'm afraid, will be some time after they are officially announced by distributors in this country.

The good news there is that Visicorp has held a press conference through its Australian distributor, Imagineering, to show the thing working (see Steve Wither's report elsewhere in Printout).

When I hear of a distributor for DesQ, I'll mention it. And as for Microsoft, given the company's terrible reputation as a suplier of boxes (a problem which executives tell me will be put right 'Real Soon Now'), when I hear of MS Windows actually reaching dealers, I'll be surprised.

Guy Kewney

Pointing devices

In the wake of the windows crept hundreds of mice. Also on show were variants of other pointing devices – light pens, touch screens, graphics pads and the like.

The most original mouse was a verb. 'To mouse' means to stop using the Pencept Penpad as an input device, and to use it to control a screen icon, instead.

'Touch the pad with the point of the pen to select graphics,' said the Pencept demonstrator to his audience. 'Then put the point over the word, click it once mouse over to the new position...'

As an editing tool this one is the best. The movements of the pen are interpreted, not just as graphics squiggles, but as writing.

So if you 'mouse' over to an incorrectly spelled word (for instance, touch the 'correct' marker on the pad, and then write the new word on the sensitive pad), the computer will pick up your handwriting as if you had typed the word at the keyboard.

The drawback of the Penpad is the $700 price – and that is the 'discount' price asked for a development tool 'for software

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vendors interested in modifying their existing packages to use the Penpad, or in writing new packages which take advantage of the Penpad.'

Included in this price is the technical documentation needed to program the Penpad. And included also, free, is a copy of the Pencommand utility, with documentation. This does the very important, inconspicuous but technically very challenging, work of creating 'command areas' for any software package you may be writing.

The company has already picked up one customer: Ocean Data Systems Inc (OSDI). This software group 'will initially develop time-keeping and billing software, targeted at the legal market-place' and will also distribute this new software 'over a unique electronic distribution service, reaching over 200 speciality computer dealers, via OSDI's satellite communications network, which allows dealers to demonstrate the latest in software to their customers, without having to stock or purchase demonstration disks.'

This order is for 1000 Penpad units. Pencept describes itself as 'a supplier of artificial intelligence products that provides a more natural way for people to use computers'. The company is based in Waltham, Mass on (617) 893 6390.

Apple announced a mouse for the IIe. Everybody got very excited about this, but you needn't think just because you have an Apple II, you can start running integrated windows on your micro.

All this mouse does is draw. It's a nice-enough graphics program, which lets you plot points, fill spaces, and draft shapes, like LisaDraw does. It even gives you graphics control of words – new fonts can be picked and printed in varying sizes.

A touch screen for the IBM micro was shown by Micro Touch Systems. 'Learning times are greatly reduced for novice users, while operating efficiency is increased for more experienced users,' says its publicity.

I remain to be convinced. I note that the warm welcome given by the micro industry to Hewlett Packard's HP150 has been taken universally as proof that users like touch-screens. In fact, the HP150 is the first HP product to sell for rather less than the competition; normally the company charges very considerably more.

I suspect this may have a lot to do with the warm response. And I have been watching ladies with long finger-nails trying to make the touch-screen work, and watching people with greasy fingers trying to clean the marks off...

Following Microsoft, the Mouse Systems Corporation has announced that its Optical Mouse (which needs a special mirror to run on) works with all Microsoft mouse-driven programs, and also with VisiOn. Apparently it also works with Lotus 1-2-3, and WordStar too, and all I can say to that is: if this works as 'well' with 1-2-3 as it does with WordStar, then I don't want one with my 1-2-3.

Mouse Systems is in Santa Clara on (408) 988 0211.

Guy Kewney

Sixth sense

Your plan is to write a program, in Pascal, or in 'C' and you are dreading the first pass through the compiler. There will be a million simple syntax errors, of the sort that any half-baked Basic interpreter wouldn't let you type.

You must immediately get Entry System for Programmers, ES/P.

It understands the syntax of the language you are typing. It won't let you type in upper-case letters where the compiler is going to want lower-case ones. It knows you meant to close the quotes that you opened at the beginning of the line. Brackets, too. And of course, in Pascal, you were going to type a semicolon just there, weren't you? It puts it in.

Actually, it's a pretty neat text editor. It lets you edit five different windows, so you can keep the top of your text on screen, and write on a different page without constantly flicking back and forwards.

Price of the ES/P package from Bellesoft Inc in Bellevue (near Microsoft), Washington 98004, tel: (206) 828 7282 is $249. For each additional language, you pay $100 to $200. You get a demo, a keyboard template, and one language free with the initial package. Fortran, Pascal, Ada and PL/M are on the way 'Real Soon Now', they say.

Yes, IBM micros only.

Guy Kewney

IBM XT plug-in

I suppose the only surprise should be that nobody else did it first: from Ann Arbor, Michigan, PC Technologies has

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HUSTLER — Unquestionably one of the best games available on the COMMODORE 64. Written in machine code and using sprite graphics to the full, HUSTLER takes game playing to new heights with its mixture of six games, for one or two players, and superb computer generated music. From Bubble Bus by Nick Strange.

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announced a plug-in system to turn the IBM XT into a multi-user system. PC says it is 'needed' but I suspect what it means is that there are lots of people silly enough to want it. Details on (313) 996 9690.

Japanese giants play chequers

By Serge Powell in Japan

It seems to me that there could be room in these fun-packed game-crazy days for a modern version of an ancient game.

Let's call it Japanese Chequers – it's an updated form of the Chinese Chequers that you might remember or still play. The object, for those who do neither, is to manoeuvre your pieces from one corner of a six-pointed star to the opposite corner. In the tangled centrefield area you proceed by jumping over your own or other players' pieces. The winner is the first to get all his pieces home.

In Japanese Chequers the layout of the board is the same but the object is subtly different. Instead of moving across the board with all his/her pieces, each player simply moves into the central area and stays put, or at most moves in apparently purposeless feints to either side, with the result that the area of no-man's land begins to look like a writhing snake-pit.

The players may as well be named: they are Sharp, Fujitsu, Toshiba, Matsushita, Sanyo and Hitachi. For the sake of variety an occasional game might include Sord or Sony or one of the others – the players needn't always be the same. The board represents the personal computer business.

But it doesn't often happen that a player drops out altogether – as a number have done in US tournaments – so you have to think of Japanese Chequers as a sort of circulating event.

Why do none of them drop out? The short answer is that they can stand a loss – home computers (or computers of any kind) are rarely the be all and end all of their existences. Sharp for example, has recently launched three new models in the PC line, but the press handout that trumpeted their merits also covered a new microwave oven, an office copier and a couple of solar-powered calculators.

Or take Toshiba. This company has a respectable range of 8-bit micros, some more powerful office systems and some Japanese word processors. Even so it is hardly a dominant force in the personal computer market.

But if you want a power plant it's the one to call on; or how about rolling stock for your electric train (not the one in the basement, the one that links Sydney and Gosford). For entertainment you could order your own TV station with all the trimmings – cameras, monitors, lighting, broadcasting equipment, even a satellite. If you fall ill Toshiba can supply the most sophisticated medical appliances, and to speed the get-well cards on their way it provides the post offices with automatic sorting equipment.

But I'm labouring the point. I could go on, or take another manufacturer or five; but let's get down to the PC and look what goes into it – memory chips, processor chips, peripherals and the rest. Most of the micro makers make their own – Sharp, for example, is using bubble memory chips where the likes of National Semiconductor gave up with the technology years ago.

This self-sufficiency adds another string to their bow, gives them greater control over quality, and reduces prices by cutting out the middle man.

If sales are slow to take off they usually have plenty of fat to live off from their other endeavours (Fujitsu is an exception, being almost exclusively a computer manufacturer, but even so it spans the entire range from micro to mainframe). They can afford to operate for longer on less, because the chances are that business will be strong in some other area in which they are active.

As operating systems bring us closer to a tolerable level of compatibility the main difference between suppliers will be value for money – that will go with economies of scale, reliability, and the range of models offered. The mêlée on the Japanese Chequers board will go on and the names will probably not change, but it's far from futile activity, especially if you're a customer – they all tend to be there from one day to the next.

American dream gone sour

By Chris Rowley in the U.S.A.

Silicon Valley, the land of hot tubs and Ferraris for the electronic tribe, right? Right indeed, but something's amiss.

No longer does every young chip designer worth his substrate hanker for the Promised Land. For a start he can't afford a house in the Valley; secondly, the Valley is taking on a darker reputation that is more the stuff of nightmares than the good life.

House prices in sought-after sections like Los Altos Hills and Portola Valley have gone through $300,000 for the basic Californian ranch house with three acres. This is at least twice what you'd pay in the most expensive suburbs back East. Nobody can afford that unless they're earning $100,000 or so, and thus companies in the Valley find it hard to recruit: to one former Valley-dweller it looks this way: 'The engineer who had a $75,000 place by a lake in Minnesota can't buy anything here.'

Meanwhile those already there are producing the sort of statistics to make sadistic psychologists drool. The divorce rate is among the highest in the country. Child abuse, drug abuse and alcoholism have become commonplace. Dads come home from 80 hour weeks working on the next generation of wonder machine in an atmosphere of entrepreneurial excitation and 'it's like coming down off a cloud,' to quote Judith Larsen, who has interviewed hundreds of Valley women. 'They just can't handle the boredom.'

'It's killing most of them,' asserts a psychologist familiar with the scene. Everyone is driven to succeed by the news of neighbours who just went public on Wall Street and made millions. They're caught up in the Silicon Gold Rush. Nobody can sleep as a result.

Life-style emulation has $60,000 a year engineers out on spending sprees on the strength of the millions they know they

will make in just a couple of years. Speaking of this phenomenon Dr Regina Kriss, a family therapist in Palo Alto, says: 'They are spending $500 on a night out – the best wines, perfect children, perfect dress . . . Meanwhile at home, they're fighting like dogs.'

Even worse for many is the cloud of paranoia and suspicion that has settled over the Valley in the wake of sundry spy sensations. Who's bugging whom? In some companies employees regularly de-bug their own offices – big companies that grew from small firms founded by defectors from older companies are wary of allowing the same thing to happen to them. They demand loyalty and will enforce it in court. Nobody knows who they can trust. IBM and Intel, among others, have taken vengeful action against insider traitors.

Anyone involved in a breakthrough project these days must move cautiously indeed.

Nor is there much safety outside the office. Spies are everywhere, serving everyone from the KGB to the Japanese computer concerns, and where there are spies there is the FBI. In addition, all manner of hustlers and con-artists float through the Valley social scene seeking their prey. The rule might be expressed thus: the more cocaine in the room, the more likely it is that some of the parties are not who they seem . . . and that someone is filming the proceedings.

One ID that many Silicon Valley people love to know is that of 'The Shadow' – the perpetrator of the micro industry's first chain letter which boosts the AIBMUGO (Anti IBM Underground Guerilla Organisation) that exhorts its readers to 'contaminate IBM's database' and claims that 'if the PC Jr is a rifle aimed at Apple's IIe Cash Cow, then networked 68000s are cannons aimed at IBM's mainframe dogs'. To join AIBMUGO write to Fourth Court, Hermosa Beach, California 90254.

But if Silicon Valley people face formidable obstacles in their pursuit of wealth and happiness they are also the first to be offered a computer driven sensory deprivation tank as a life-style aid. Psykon of Palo Alto charges $20 an hour for a two hour session lying in a brine-filled tank while an Apple II drives a video system floating in the dark above your head, to feed your brain such images as the perfect backhand over and over, in video and slowmo, with compugraphics – until you get it right.

VisiOn

After all the advance publicity, VisiOn finally hits the streets. Now we know it's for real, will it actually live up to its promise, or will there be an expectation gap as wide as the one experienced by many pioneering managers when they took delivery of their first microcomputer? After all, that gap was the reason that VisiCorp invested $10 million in the development of VisiOn. Unfortunately, that question must go unanswered for the time being – it would be a braver man than I that would be prepared to offer an opinion based on a couple of hours use.

It was clear from an afternoon spent at the offices of Imagineering (VisiCorp's Australian distributor) that VisiOn has potential. Whether or not that potential will be realised will depend largely on the amount of applications software that is produced for it. At the time of launch, the spreadsheet (VisiOn Calc) and graphics (VisiOn Graph) programs were the only ones available. A pre-release version of the word processor (you guessed it, it's called VisiOn Word) was demonstrated, and apparently a database system is in an advanced stage of development. Virtually all VisiOn users will rely on commercial software, as it is not possible to develop applications on a personal computer. Development is carried out on either a VAX supermini, or a very expensive 68000-based system. This has its advantages for software houses, as the development systems can easily produce versions for any machine running VisiOn, but it means that only large organisations will stand much chance of developing their own software.

A further problem is that moving data into or out of VisiOn isn't possible, except for using VisiOn Calc to read a VisiCalc file, etc. On the other hand, transferring data from one VisiOn machine to another is supposed to be relatively easy.

Part of VisiOn's promise is that it offers a simple, consistent user interface, and (so far as I could tell), it does. For example, it is always possible to abort a command sequence by pointing to the word STOP at the bottom of the screen. All windows have the same layout, with a menu at the bottom, the prompt line immediately above, and the name at the top (see the photographs). You get to know your way around very quickly.

There is one aspect of VisiOn that does not show this consistency – a given operation does not always take the same amount of time because VisiOn

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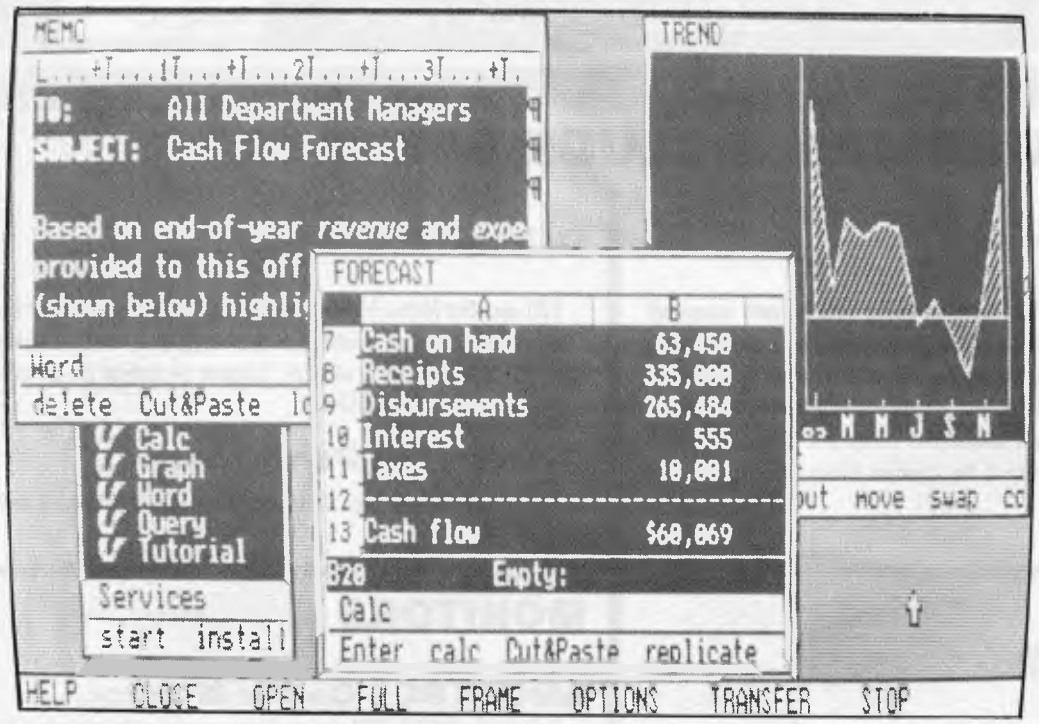

VisiOn showing its "windowing" capability.

swaps code and data in and out of memory as necessary. If a required routine isn't in RAM VisiOn may need to write a chunk of memory to disk to make room for it. I found this more annoying than you might expect, probably because of the generally consistent behaviour of VisiOn.

The particular species of mouse adopted by VisiCorp is the two-button optical variety. Having two buttons makes scrolling a simple task (press the 'scroll' button and move the mouse), providing you remember which button is which! I watched several other people using the system, and a fair proportion seemed to be having the same problem as I did. The optical nature of the mouse means that it can't run around your desk like the mechanical types – instead you need a striped reflective plate about the size of this magazine. The long-term question is

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When you meet a computer salesman who boondoggles you with jargon about RAM, ROM, BITS and BYTES drag him back to earth. Don't be ashamed to say you don't understand. More often than not he doesn't either . . . it's a con.

Tell him what you want. A machine your children can use for their education. Find out if he knows how computers can really be used for educational purposes. If he squirms or doesn't give a sensible answer then don't take any notice of his advice. If he doesn't know anything about education how can he advise you whether his computer is good for educational purposes?

WE RECKON WE KNOW BECAUSE THATS OUR JOB.

I suggest that you nextask each of the salesmen whether they will show you a catalogue of educational programmes for their machine. Ask each one of them whether their machine has more than 20% of the programmes written for the Apple and Apple compatible computers.

If they say that their computer does have more than 20% of the educational programmes written for the Apple, then I suggest you visit us and look at our catalogues and draw your own conclusion as to whether you can trust that salesman.

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First comes a the Redstone TR002D —
A brand new 64k computer that not only runs Apple programmes but also has a second Z80 computer on board that uses the same monitor and drives. Unlike the Apple II« it also has built in lower case and a separate numeric keyboard. It gives you 66 function keys, a user defined keyboard and auto repeat too. Quality? We reckon it's tops and to show that we mean it we give a 6 months guarantee. That's twice as long as Apple.

It will cost you **$699** inc tax and **$639** ex tax

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Your second choice is the TR007. Same as the machine above except that it has the same features as the more recent Apple IIe. Full cursor keys and automatic repeat on all keys.

That costs **$999** inc tax and **$891** ex tax

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Finally there's the Prince of Apple workalikes . . . the Medfly.

You can of course take a basic Apple II and add on an 80 column card, a Z80 card, an extra 64k of banked memory, a serial port and a parallel printer card. Then you could replece the traditional Apple styling with a new slimline keyboard with function keys and full cursor keys and stick a fan on the side.

Maybe you would run the same programmes but it would cost you a heck of a lot more and you wouldn't have a machine that could hold a candle to the Medfly.

Funny name the Medfly until you think about what kills Apples . . . You got it! The Meditteranean fruit fly.

The fully optioned up Medfly computer with 128k memory will cost you **$1575** inc tax and **$1390** ex tax. On top of that you have to add the cost of a monitor and a disk drive controller and if the budget will stand it, a printer. The 64k Medfly will save you **$1375** inc tax and **$1222** ex tax.

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whether the claimed improvement in reliability over mechanical designs is enough to outweigh the inconvenience in use.

Transferring data from one application to another is a simple matter. Basically you select the material you wish to move, choose the transfer function, and then indicate the destination. An obvious application is the production of graphs from a spreadsheet. Something you can't do at present is copy a graph into a word-processed document, although this is promised in later releases of the software. In the meantime the windows make it very easy to gauge the amount of space to leave in the text in order to cut and paste (the real scissors and glue method) the printed output.

For all its advantages, I think VisiOn has two main drawbacks. The first is that a potential buyer is looking at a relatively large investment. On the hardware side, you're looking at a machine with at least half a megabyte of memory plus a five megabyte hard disk, graphics, and a mouse. Say you already own an IBM PC, and it's fitted with the graphics adaptor. Imagineering's price list shows the Quadram 512k memory board at $1240, the Davong 5Mb winchester at $2620, and the VisiOn mouse at $445. Having spent well over $4000 on top of the cost of the computer itself, you are able to run VisiOn, which costs a mere $165. Trouble is, you still can't do anything – first you must buy the applications programs you need. List prices here are $630 for Calc, $595 for Word, and $395 for Graph. There are two package deals, VisiOn with Calc and Graph for $1099, or VisiOn plus all three applications for $1499. Can VisiOn save a manager enough hours over a couple of years to repay the investment? You must do your own sums.

The other problem is the difficulty of producing custom applications. Big corporations will be able to cope, and apparently several software houses are investigating the possibility of producing specific applications for the vertical markets they already serve, but if you currently use a specially written program for a task that doesn't fit the spreadsheet or database mould, forget it. If the hardware was cheaper, perhaps it wouldn't matter so much.

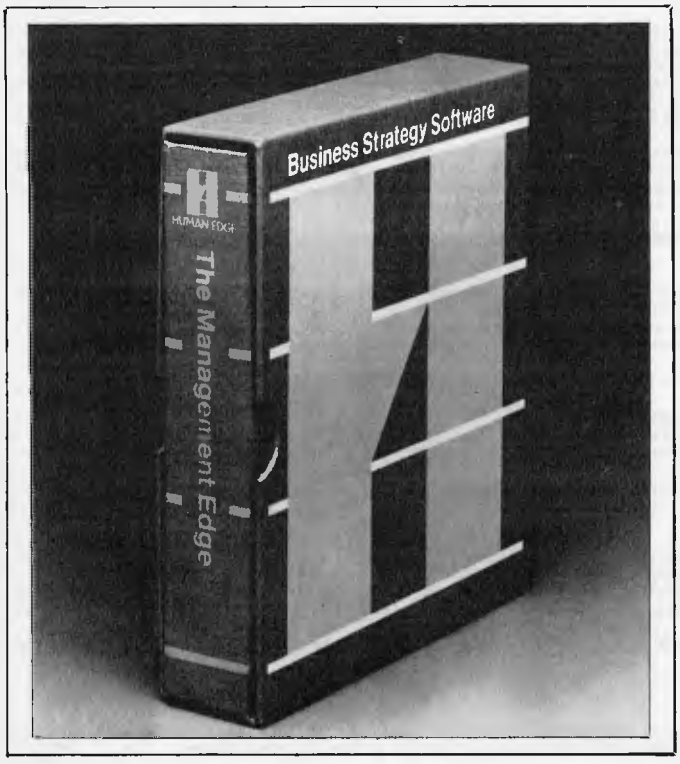
Steve Withers

Macintosh

Considering the number of rumours about Apple's Macintosh project, it isn't surprising that many of them were wrong. The people who suggested it would be a cut-down Lisa were the closest, but those who predicted MS-DOS compatibility were way off line.

One thing that I didn't bargain for was the ballyhoo with which Apple launched the Macintosh — stirring music, videos, slideshows, artificial smoke, rap dancers ('We are Apple' sung to the music of 'What a Feeling'), and a TV celebrity acting as front man. Decidedly over the top, but presumably for the benefit of the mainstream press and the TV cameras.

For me, the most cringe-inducing part of the proceedings was a slogan to the effect that the Macintosh is one reason why 1984 won't be like '1984'. Being told that the signatures of the design team were moulded into the Macintosh case had a



You're not going to believe this.

The Human Edge has launched a program 'which develops a problem-solving strategy tailored to the personalities of the superior/subordinate/peer triad, and to the culture of the work environment.'

Translated, this means that you go to the program with the following problem:

'Dear Aunt Computer, my boss is a mean old bully, and he wants me to get five thousand labels printed by Thursday. But my colleague Peter is using the computer to play Space Invaders, and he thinks the mailing list isn't really that urgent. Now I'm a very quiet little thing, and I can't tell Peter what I think of him, and anyway, in this stupid company you have to be the chairman's nephew or a beautiful person to get on, so how are we going to get the labels printed? What am I going to tell the boss?'

To use the program, you turn the machine on 'and choose from six assessment selections: self-assessment, interactions with others, compatibility with the organisation, problem-solving with subordinates, determining your management skills and assessing a superior.'

After the user answers a series of questions, says the company, 'the machine assimilates information from a bank of proven management tactics, and selects those most appropriate to the situation'.

Dr James Johnson, president and founder of Human Edge Software, and the author of over 100 articles and books on personality assessment, says 'The Management Edge offers a new method of understanding and communicating with co-workers, subordinates and superiors, by presenting expert management advice that can enhance a manager's overall performance.'

Not greatly to my astonishment, friends who tried this out report that its print-outs are pure nonsense.

If Americans will buy this sort of stuff, then no wonder they all see psychiatrists. They're all mad! And no, I am not making it all up, and yes, you can buy it, for $250, form Human Edge Software Corporation, 2445 Faber Place, Palo Alto, California, on (415) 493 1593.

similar effect on other people, but it struck me as being a nice touch.

Enough of all the hype, what about the machine itself. The biggest surprise was Mac's small size, the footprint being just 24cm square. As with the Apple II, there is even a padded carrying case available as an accessory item, but this time everything fits inside, even disks and manuals.

Macintosh is very Lisa-like, with the now familiar 'electronic desktop' display and mouse-driven software with so-called pull down menus (to me, they seem to pop up on demand). The big difference seems to be that Macintosh can only do one thing at a time: as far as I could find out, it is necessary to put one application away before another one can be activated. This makes the transfer of data from one program to another a little more time consuming than it would otherwise be, but it is still a simple process.

While Mac's system software includes a calculator and notepad, you can't really do anything without some applications programs. Fortunately, Apple are throwing in the MacWrite and MacPaint programs (word processing and free-hand graphics) as an introductory offer. I can't see that offer lapsing, somehow.

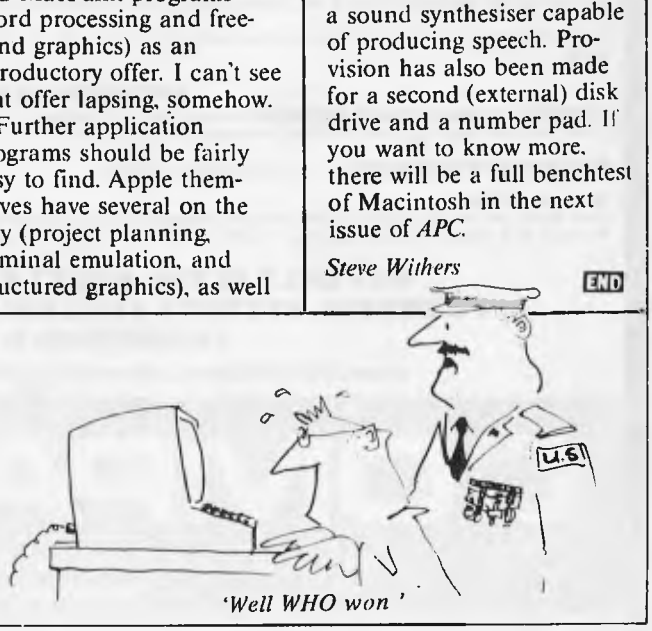
Further application programs should be fairly easy to find. Apple themselves have several on the way (project planning, terminal emulation, and structured graphics), as well as programming languages (Pascal, Basic and Assembler). Microsoft predict that 50% of their 1984 retail sales will be for the Macintosh. They already have Multiplan running, with other programs under development. Lotus 1-2-3 is well on the way, along with programs from a considerable number of other software houses.

What's the big attraction of the Macintosh? It's just *so* easy to use. When I wasn't playing with one myself, I watched other people working on a Mac. We all made mistakes at the beginning, but it looks like Apple's claim of a very steep learning curve is justified. Macintosh is also competitively priced at $3445 including tax. Most buyers will probably want the Imagewriter printer so they can print documents containing all those nifty typestyles and graphics, and that takes the price to $4195.

Oh, for those who really care about such things, Macintosh has a 68000 processor, 128k RAM, 64k ROM, a 9" 512 by 342 bit-mapped display, one 3½" 400k microfloppy disk drive, a detached keyboard, a mouse, two serial ports, and a sound synthesiser capable of producing speech. Provision has also been made for a second (external) disk drive and a number pad. If you want to know more, there will be a full benchtest of Macintosh in the next issue of *APC*.

Steve Withers

END



'Well WHO won'

THE EXECUTIVE 816 . . . . . A REAL COMPUTER IN A REAL BRIEFCASE
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We think the two most important features to look for in a small business computer is the quality of the sofwtare and the capacity of it's drives. Let's take these two points one at a time and look at the Executive 816.
Why is the drive capacity so important? Well for instance, it is usually most efficient to adjust your stock and debtors records as you write up your customer invoices That needs them all to be on in the drives at the same time. Then again with good sized disk storage your database can be a usable size, or you can store a really substantial amount of text from your word-processor as well as a good sized dictionary to check your spelling. Unless you have a midget business you are unlikely to be able to do this with less than 1,500 kilobytes of storage. The Executive 816 has nearly 1,600 kilobytes of storage built in to two slimline drives. As a comparison, the Model 3 or 4 TRS 80 have 384 kilobytes, the basic 2 drive IBM PC has 750 kilobytes. The 2 drive Apple 2e has a measly 286K storage.
So what does it all mean? Simply that even though it comes in a small portable package the 816 is one of the most powerful computers available on the market at anywhere near it's price bracket.
The second issue is the quality of the software. The 816 comes with an enhanced CP/M 2.2 operating system developed by Mark Henry of Compak Microcomputer Products. It is menu driven, You don't need to understand A> or PIP or Stat or any of the other built in CP/M commands. Just choose the option from the menu and the computer tells you what to do. Follow the yellow brick road. You can copy, format, look at the directory, run programmes, set up communications or even get into CP/M itself. The 816 can read 5" disks from the DEC Rainbow 100, IBM PC (CP/M 86), Kaypro, Cromemco, Osborne, HP 125, Morrow Micro Decision,. Televideo 802/803, Archives 2 and soon even more disk formats.

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A Print Spooler is also on-line. Print while you type the next document. Above all, Super Writer is very easy to learn and use.

A DATABASE
From Australia comes the ARM Data-Base, with forms management. It is not just a file management system.
There are no complex commands, and the quality and sophistication of the data-base make the system easy to use; everything is menu driven and a demonstration data-base is supplied.

SUPERCALC
One of the best known and supported spread-sheet programmes is also supplied free with the 816.
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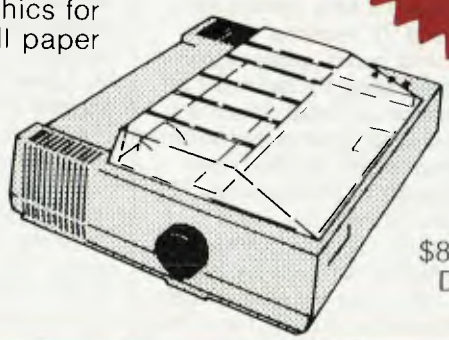

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APC welcomes correspondence from its readers but we must warn that it tends to be one way! Address letters to: 'Communications', APC, P.O. Box 298, Clayton, Vic 3168.

Comparing processors

Your recent review of the Tandy MC-10 (*APC* December) states that the 6803 processor is almost identical to the 6809. In fact, the 6803 is almost identical to the basic 6800 CPU in software terms and not the enhanced 6809 CPU. I suspect that one of the reasons for choosing this processor is that Tandy may be considering putting the Basic on-chip with the processor in the form of a mask, programmed 6804 CPU.

Here is a brief summary of the 6800 processor family:

6800 original CPU (requires separate clock)
6802 6800 with on-chip close+128 bytes RAM
6801 6800 single-chip microcomputer ie CPU+clock+128 bytes RAM+ mask programmed ROM+i/o ports
6803 6801 with no ROM ie 6800 CPU+clock 128 bytes RAM+i/o ports
6809 greatly enhanced version of 6800 with on-chip clock (no RAM or ROM)

Others

6808 as 6802 with no RAM
6804/5 special mask programmed single chip microcomputers
6301 CMOS versions of 6801
68701 EPROM version of 6801

This above is an over simplification, in that 6802/6808, 6801/6803 may contain a few extra instructions over the basic 6800 instruction set.

It is not always realised that comparing clock speeds between the 68xx range of processors and the 8080/8085/Z80 processors is not very informative, since many 6800 instructions are executed in two or three cycles, as opposed to instructions which take many more cycles on the 8080/Z80 processors.

Simon Sondergaard

Understanding Basic

Don Milne's (*APC* December, 'Basic challenge') comments on my letter (*APC* October, 'Back to Basics'), merely repeat some of the cliches about the superiority of Pascal without showing, in any way, that he understands the nature of the problem previously described.

High level languages and operating systems are designed to ease the work of programmers. By their use much time and money may be saved in the writing of programs. This ease is normally at the expense of added run time costs which is balanced against the saving in software costs. However, language and system designers tend to assume that they know all the ways their software may be used and often, deliberately or by omission, bar the full use of the CPU. Pascal is such a language, and whilst excellent for many purposes is very inflexible and inefficient for others.

I write critically of Pascal because I have tried it and found it wanting. I had several years using Algol which allegedly had some influence on Pascal. It too is a compiled language but suffers from some of the same difficulties. Programs ran *100 times faster* when a few time critical routines were optimised in machine code.

My 'long winded' remark referred to running time. The Pascal code may well be shorter. It certainly was in the Algol program, due to each bit having to be handled separately. In addition the arrays were many times larger, which led to memory difficulties. One run might take several days even with an efficient program and perhaps months otherwise.

The published routine has been simplified to show the essential problems. In practice it would have many extras such as loops to repeat parts.

The routine is designed to sum sequences of 16 bit 'integers' but without permitting any carries between bits of higher or lower significance. Each bit is an independent data item which must be kept unaffected by any other bits. In line 1000 S1,S2,S4 and S8 are counters for each power of 2 in the total. For the example, they are preset at –6 and total up to 12 'integers'. A wide range of values would be possible in practice and S16, S32 etc might be used.

Lines 1010-1030 take pairs of 16 bit 'integers' from an array S( ). Each pair is masked with R and NOTR (does Pascal allow Masks?) and ORed to give a single 16 bit word. R is produced by other routines to complex rules and is highly variable.

If S8 is non zero this indicates that some bit counts have negative values. Lines 1190-1280 convert any negative values to positive absolute values. Lines 1210-1225 separate positive and negative counts by masking to the sign bit. Lines 1230-1250 convert negative counters to their 2's complements. Line 1260 masks any spurious bits and line 1270 combines the counters again. Other masking code, not given, would access the counter totals whenever required.

In Pascal these 16 counters would have to be handled in sequence rather than in parallel and the lack of masking facilities would also make the value extraction time consuming. The bits would have to be treated as 16 separate variables.

I would repeat my earlier remarks that I would be pleased to see the problem written in effective Pascal.

I would also like to point out that compiled Basic is frequently used in business programs with some success. Since many smaller systems do not support Pascal, life would otherwise be difficult for any business with such an installation.

R.G. Silson

Spectrum command

I read somewhere recently that the following direct command returns the amount of memory used by a program on the ZX Spectrum. PRINT PEEK 23627 + 256 PEEK 23628 – 23755.

Since I have a 16k machine, memory space is fairly important. When writing a program recently I discovered I had used all the available memory, but this direct command only returned approximately 8000 bytes. Is it the way that I only have 8k RAM and 8k ROM, or that the value returned should be doubled – I have been unable to discover which. Could you help?
Kevin Barrett

Your 16k Spectrum has in fact 32k of memory, but the first 16k of this is the ROM and includes the Basic interpreter. The other 16k is called the RAM but not all of this is available to you for your programs. This is

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because the Spectrum needs this space to store the contents of the display file (the screen picture), the printer buffer and the system variables. These are the machine's own variables and store information which describes the current state of the system. Some of these variables are pointers to the start of the flexible areas of memory, for example, the area set aside for your program.

Incidentally, the names of these variables are meaningless to the machine and shouldn't be used in programs, and only exist for our benefit since it's easier to refer to VARS than PEEK 23627 + 256 PEEK23628.

Taking into account all these overheads the amount of RAM available for your programs is about 9k.

To find out just how much of this precious memory you have used, you PEEK the values of the relevant system variables. To determine the memory used by a program = PRINT (PEEK23627 + 256 PEEK 23628) – (PEEK23635 + 256 PEEK 23636).

To determine the memory used by a program and its variables PRINT PEEK23641 + 256 PEEK23642) – (PEEK23635 + 256 PEEK 23636).

Finally, to discover how much memory is spare use the command PRINT 65536 – USR 7962.

This is, in fact, a routine in the ROM memory and is used because there is no convenient system variable.

Tony Hetherington

Which typewriter?

Can you please advise me which typewriters to consider buying as part of a basic word processor? – Permit me to expand on my own requirements; I know they come close to those of many other small users.

My small business handles a lot of multi-page texts and I need a robust electric typewriter, which will mildly impress customers and not drive me up the wall with servicing problems. We have budgeted about fifteen hundred dollars to buy a good keyboard typewriter, and will buy a basic microcomputer and floppy disk unit to drive it when the money becomes available later. We don't want a turnkey word processor system with opaque software and non-adaptable hardware, so we shall probably go for a PET, Tandy, Apple or such market leaders, plus a commercial work processing program package. Therefore, the typewriter must be readily connectable to such machines.

Please interpret typewriter to include daisywheel machines, but to exclude dot-matrix printers.

Anthony Durham

There are any number of typewriter/printers available. One which would seem to meet your requirements is the Olympia Compact, which uses a daisywheel, has a choice of serial or parallel interface and has the option of a 64 or 128k print buffer. There are, however, many other machines which would prove equally suitable; just look through the ads in APC! As with any computer equipment, I recommend going to an independent dealer who will be able to offer unbiased advice on your particular requirements.

Surya

Software copyright

Attached is a copy of a draft letter sent for consideration to Senator Gareth Evans,

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Attorney General from the Victorian Council of Social Service (Phone 03-419 3555):

VCOSS is currently working, together with other concerned organizations, on a detailed submission against proposals for computer software to be made subject to copyright.

This letter is just advance notification that we wish to be heard before any decisions are made. We are concerned at a trend in press comments to assume that there is simply a "loophole" which the Government will "have" to fix through special legislation.

At this stage all we are asking is for you to refrain from any public commitment to that position until you have had the opportunity to consider arguments against it, and to decide whether such arguments merit further public enquiry.

Briefly, our view is that copyrighting computer software would not be merely protecting the status quo by closing a loophole, but would amount to seizing a substantial amount of what is presently public property and enforcing a private monopoly over it. If such a step can be justified in the interests of some alleged, future, potential Australian software industry, then it should at least be publicly shown to be justified through the usual process of a public inquiry by the Industries Assistance Commission. Other forms of public inquiry may be appropriate, but certainly there can be no justification for emergency legislation in support of one side of a dispute without giving the other side an opportunity to be heard.

The "other side" includes not just the small handful of distributors of "fake Apples" and the like, but the much larger number of *consumers* of computer software – both those who are already treating it as "public domain" anyway, and those who have up to now paid monopoly prices through ignorance, but will now be able to benefit from free competition, unless prevented by new legislation.

We doubt whether continuation of the present situation would actually harm any existing Australian industry and note that the concern expressed so far appears to reflect a fear of Australia becoming an international centre for low cost uncopyright software. This would in fact be a *new* industry that should be encouraged rather than legally suppressed. Fear of competition from a new industry is not so overwhelmingly obvious a ground for legal protection that it should be accepted without inquiry. Particularly when the fear expressed is that an Australian industry might develop to meet the domestic market for, and to begin substantial export of, goods that are presently only available in Australia as imports. Usual claims for protection start from somewhat different, or even opposite assumptions.

The main argument however, is not the potential for new industry, but the benefit to consumers from continuing the present situation. As we understand it, the main benefits likely to flow from new technology, including computer software, do not relate to the existence of industries producing that new technology, but to the advantages of improved productivity etc. for those using it. If it could be shown that failure to provide copyright protection for computer software would in fact so inhibit its production that the opportunity to use it would itself be harmed, then that would be an argument in favour of copyright - an argument which should be justified by adequate evidence at a public inquiry. But if, as appears obviously the case in Australia at present, copyright would have more effect inhibiting consumption than it would

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have stimulating production, there are no grounds for even bothering to inquire into the matter - who needs it?

Our own organization for example, makes use of a considerable amount of uncopyright computer software which has been made available to us entirely free of any direct or indirect charge. Although this software displays messages asserting that it is copyright, and although we have seen advertisements making similar claims and charging thousands of dollars for "licences" to use this public property, we have not thought it appropriate to take any action under the Trade Practices Act or the Copyright Acts s.202.

We have been content to rely on the fact that there *is* no copyright for computer software in Australia, and on the assumption that we would have the opportunity to present our case if any serious moves were made to change that situation. This situation is obvious to anyone perusing the Copyright Act, which explicitly restricts "writing" to works in a "visible form", and is a fact which must be well known within both the legal profession and the computer industry, since long before the recent Apple case. Comments have been made on this situation in legal textbooks and journals (see Lahore, J. "Intellectual Property in Australia" and the associated update service from Butterworths), and submissions have been made against it from the computer industry to the Attorney-General Department's review of audiovisual copyright laws. Accordingly, nobody can pretend that there is some new, "emergency" situation that would justify urgent action without a public inquiry.

If other people want to make *ex gratia* payments to encourage the production of further high quality software that may be very commendable on their part, although our own orientation, as you know, is towards public funding of social services rather than private charity. If software suppliers wish to make misleading statements to encourage donations, that is less commendable, but perhaps understandable, given the absence of an acceptable system of public funding such as is used to finance scientific research, literature, the arts etc. (Our own obligations to properly account for our funds have prevented us making any such donations, without compelling us to do anything further about it.)

But if someone wants to actually make it *illegal* for us to continue using what was previously in the public domain, then we have no choice but to fight back.

Our organization simply cannot afford to pay the thousands of dollars that would become due if software we are using was to be taken out of the public domain. Current plans for an expansion of computer useage among our many affiliated organizations would be severely retarded. At the very least we would expect compensation to cover our present and future losses. If such compensation were not provided, it would create requirements for additional funding just to cover the same level of activities that we are able to sustain at present.

We know a similar situation is widespread in the education sector, where the "fake Apples" that Apple has been trying, unsuccessfully to stamp out, have enabled schools to buy something like two or three times as many computers as they would be able to afford if they had to pay Apple's monopoly prices. As for software, schools simply don't have the funds to buy it, and have therefore had no choice but to permit or encourage widespread copying (whether they knew this was legal or not).

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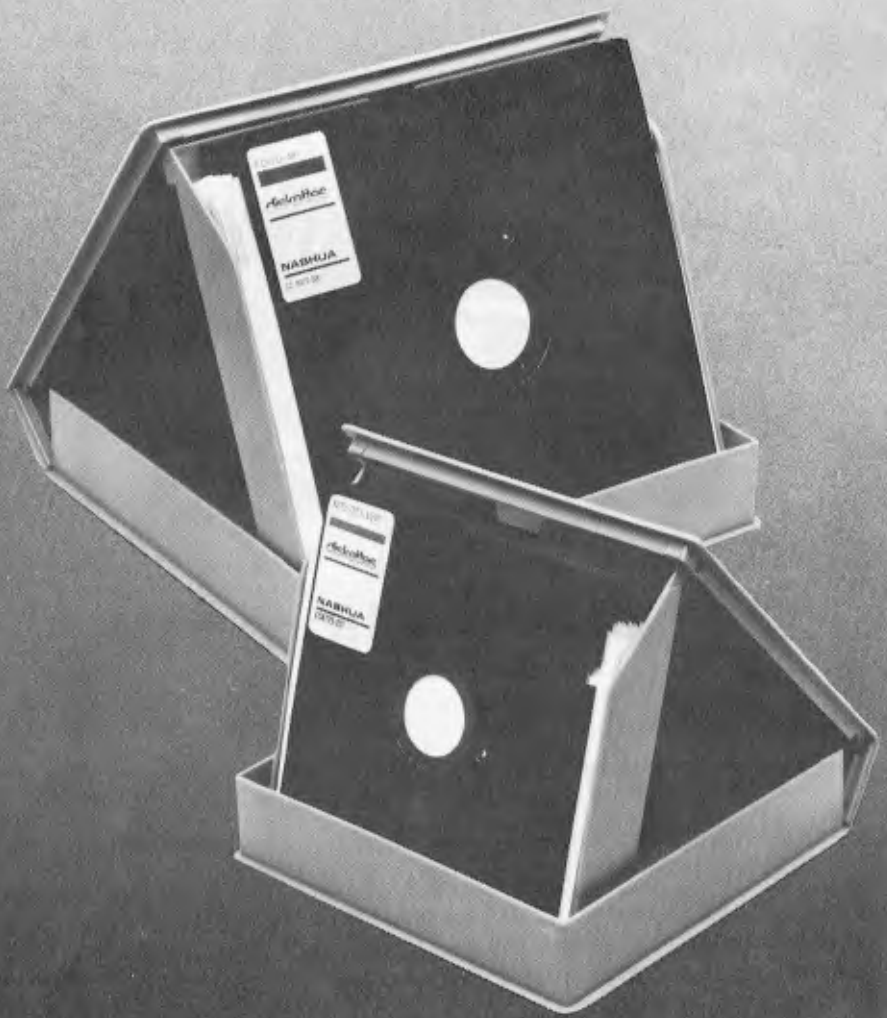

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templated, it would at least be necessary to provide appropriate exemptions for educational institutions, community organizations etc, and to set up appropriate machinery as has been done in the present Act to cover photocopying and broadcasts. We would of course wish to be consulted in framing any such legislation, to ensure that the restrictive regime now being imposed in the United States does not get imported here without discussion, as though it were something "uncontroversial".

No doubt the temptation would exist to resolve these problems by groups concerned simply ignoring any new legislation, but that is hardly an argument in favour of adopting such legislation, and it may not be practical in view of the aggressive attitude currently displayed by Apple.

Finally, we are not unsympathetic to the problems faced in establishing an Australian software industry without copyright protection, and we are prepared to support some form of assistance to the industry. Our concern is that the form of assistance currently being proposed is totally inappropriate, while other forms of assistance, such as public funding of software research and development, could actually be more beneficial to any software industry itself, as well as imposing no penalties on users.

The kind of assistance currently being demanded by "industry representatives" is equivalent to an extremely high rate of tariff protection, which would not usually considered appropriate in a situation where the overwhelming bulk of a product consumed in Australia is imported, and the overwhelming bulk of that same product produced in Australia is produced for export. Our own experience is that software packages we find useful are all produced outside Australia, and no equivalent Australian packages exist - protected or otherwise.

Most industries would think it rather breathtaking to get a 100% tariff since that means that Australian consumers are being compelled by law to pay twice as much for goods they would otherwise be able to get for half the price. Imposing a substantial monopoly price on goods that would otherwise be virtually free, amounts to a record tariff protection of several thousand percent (indeed theoretically, an infinite tariff rate).

No doubt a decent size Australian air bottling industry could be established if laws compelled people to breathe only Australian bottled air by prohibiting the inhalation of free air that may have blown in from elsewhere, but fairly compelling arguments would be needed to convince many people of the need for such an industry.

Interconnecting Apple

Dear Sir,
I read with interest the report by Guy Kewney on "Apple expander" (page 7, November, Printout).

Both Apple Australia and NetComm are still maintaining a fairly low profile on the interconnectability of the Apple II (II+, //e) and Apple ///. However as of Comdex Fall in Las Vegas last week, the "Apple Communications Protocol Card" (ACPC) is a live announced product. "ACPC" is the official Apple name for our NetComm card.

You can thus now expect to see more details of Apple to Apple connection (using the IBM 2780/3780 protocol).

However, and please tell Guy, there certainly *is*, right now, a way of passing information from one Apple to any other Apple (II or ///) (using

COMMUNICATIONS

the above protocol), either by local or remote telephone connection. *Any* DOS 3.3 file may be sent, and stored, on Apple ///'s under SOS *and* vice-versa.

Quite what one would do with Applesoft under SOS or a SOS.KERNEL file under DOS 3.3 is for the user to decide. Text file transfer is far more probable.

Please don't let your users get the wrong idea. There is a way to pass information from Apple II to Apple ///. Finally, keep up the excellent quality of your magazine.

C.E. Howells,
Managing Director,
Data NetComm.

Colour display

I am considering buying my first home computer which would be used for games and hobby, but it must be capable of giving sharp, clear, steady display on the screen, preferably in colour.

Could you please advise if my Sony 18in colour TV – which gives excellent definition – would give equally good display from, say, an Atari games program (if available in colour), or colour graphics.

Alternatively, would a 12in VDU give a higher quality display than a 12in TV in the same price range?

DF Kerr,

Unfortunately, matching up TVs and micros is very much a hit-and-miss affair. In my experience, Sony sets seem to work with just about any machine.

A colour monitor would undoubtedly give a better picture than a television set since monitors accept a direct video input, whereas a TV set needs to be tuned in. Monitors give a steadier picture, sharper definition and more accurate colours. And TV sets are – after all – designed for use as TV sets, not as computer monitors.

Not all machines have a video-outline for use with a monitor, so you will need to check whichever machines you have in mind. There are also TV sets with a direct video input as well, these having a 'monitor channel'. You need to tread carefully here, however, since some TV sets have a channel marked 'video' or 'monitor' which turns out to be nothing more than an extra TV channel.

Assuming your machine has a video output, the choice is very much a personal one. Try your TV set first, and if you're not happy with the quality then try a monitor. Monitors do not, however, come cheap. They generally start at around $500 and cannot – of course – double as TV sets.

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INTERFACING THE APPLE

R C Baker presents his design for an interface unit which makes full use of the games input/output socket on the circuit board given here for the Apple II. All the components are listed, together with a program to demonstrate the interface in action.

The Apple II has a number of inputs and outputs which are dedicated to 'games' purposes. These I/O facilities are provided on a 16 pin DIL socket on the top right of the Apple's PCB and are as follows:–

Apple Reference

3 off push button (single-bit) inputs
PB0, PB1, PB2
4 off variable (analogue) inputs
GCO, GC1, GC2, GC3
4 off switch outputs
AN0, AN1, AN2, AN3

The single-bit inputs can be used with switches to provide inputs to the Apple; the analogue inputs can be used with switches to create more single-bit inputs, or with variable resistors to provide games paddles. The switch outputs are TTL signals, and change from high to low or low to high when the output memory locations are referenced. These will drive lamps, relays, etc, via a simple transistor interface.

I have devised an interface unit which tries to make the most flexible use of these inputs and outputs for games and other 'non-keyboard' software. The circuitry used in my interface is more complex than necessary, for a number of reasons, and hence a simplified circuit diagram (Fig 1) is given which is adequate for the program described below.

The interface plugs into the DIL socket on the Apple, and provides the following on its facia panel:

3 push button switches A, B, and C
4 illuminated push button switches 1, 2, 3, and 4,
1 DIN 5 pin socket for connecting three games paddles
1 DIN 6 pin socket for driving external relays, etc.

The lamps in the illuminated switches are driven from the outputs AN0-AN3.

The circuit diagram shows the layout of

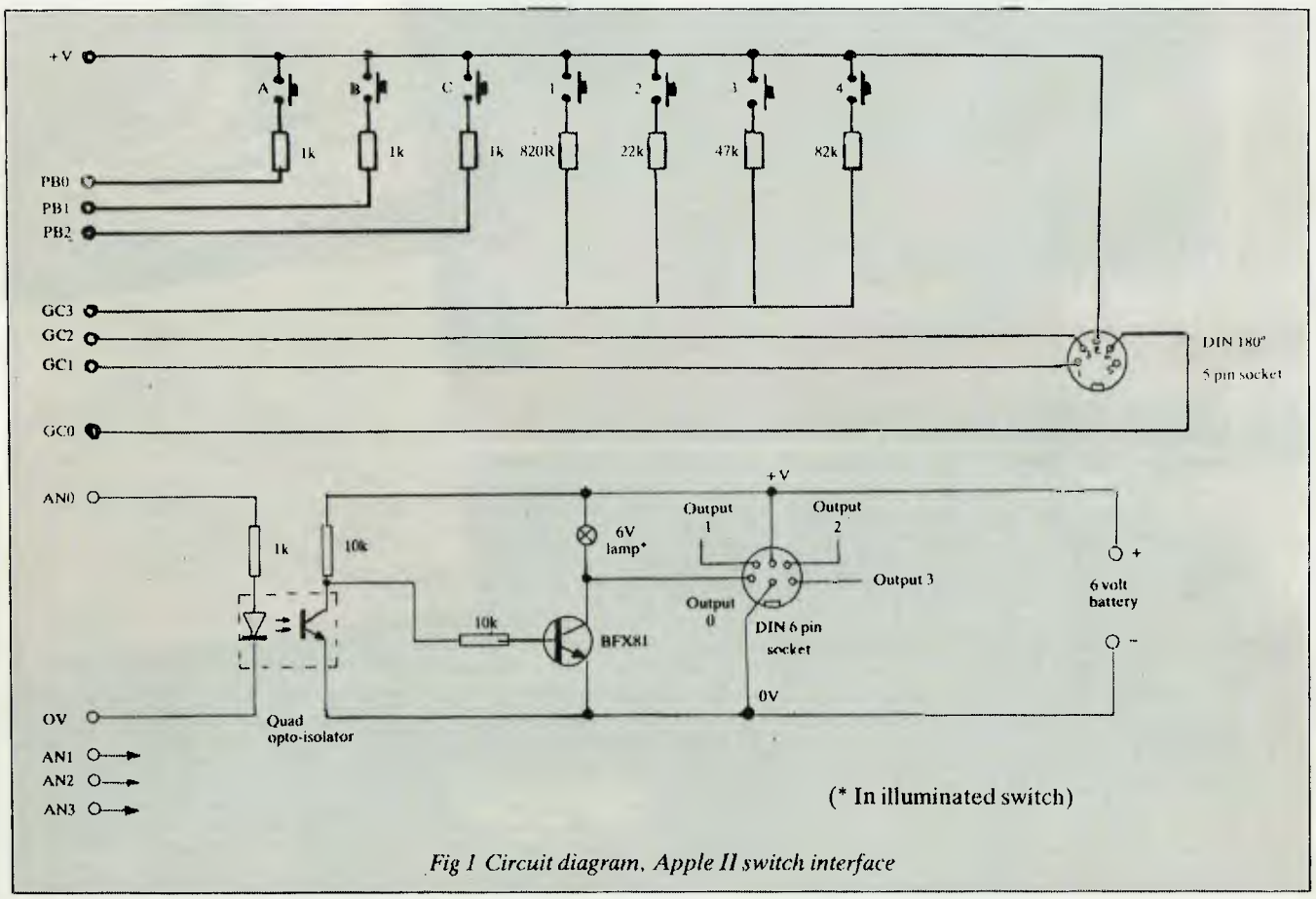

Fig 1 Circuit diagram, Apple II switch interface

the interface, from the 16 pin DIL Apple socket to the front panel switches. The circuit may be battery powered (6 volt) or driven from a mains power supply as in my unit. This is shown in Fig 2. Fig 3 shows a front panel layout which can be used, although this can be varied to suit the individual, and may be dependent on the box used to contain the interface.

The switch inputs A, B, and C, are straightforward, being connected directly to the appropriate Apple inputs. The 1k resistor provides a suitable current-limiting device between the Apple's five volt supply and the input. Analogue input GC3 is used to provide the switch inputs 1, 2, 3, and 4. Each switch has a different value resistor and hence presents a different value on the analogue input. The only drawback with this is that the Apple cannot correctly interpret two or more of these switches if pressed simultaneously — this does not present a problem in the program described below.

Games paddle inputs GC0, GC1 and GC2 are taken to the 5 pin DIN socket, together with the +5 volt supply from the Apple. Games paddles and/or joysticks can now be plugged in at this point. Note that the normal value of variable resistor is 150k, which gives readings from 0 to 255 depending on its setting. Larger values than 150k will have no effect (ie, 255 will be returned), whereas smaller values will reduce the upper limit (for example, a 10k variable resistor will present a maximum reading of 23 to the Apple).

The outputs from the Apple are optically isolated to prevent possible damage to the computer if a peripheral device were to short circuit or fail. A quad opto-isolator IC is used to provide this protection — for clarity only one of the outputs is shown — the others are identical, using the other channels of the opto-isolator and a driver transistor each. The transistor chosen will switch several hundred milliamps without difficulty.

The unit described here can be easily constructed by anyone who has some familiarity with electronic assembly, and there should be no difficulty in obtaining components and a suitable case. Note that the construction method and layout is not important — a small piece of veroboard will take all the components, and ribbon

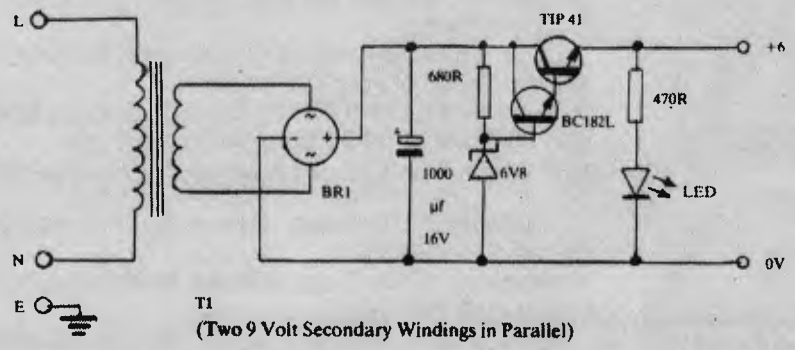

Fig 2 Mains power supply

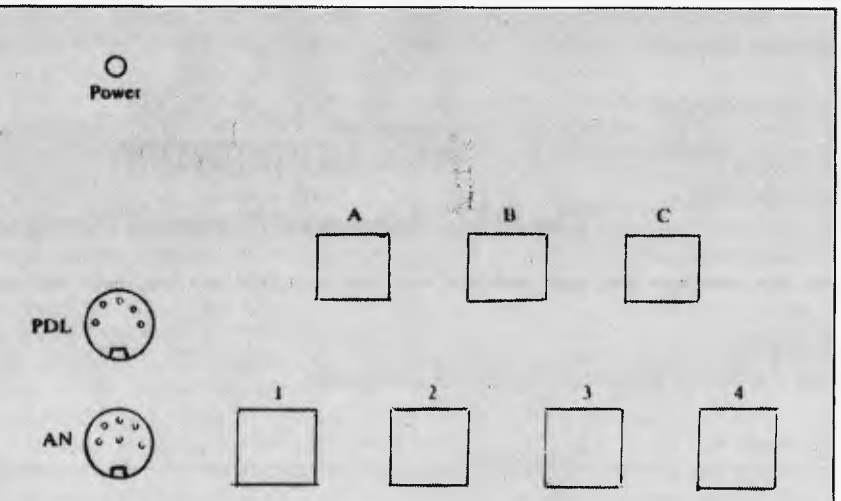

Fig 3 Apple II switch interface unit

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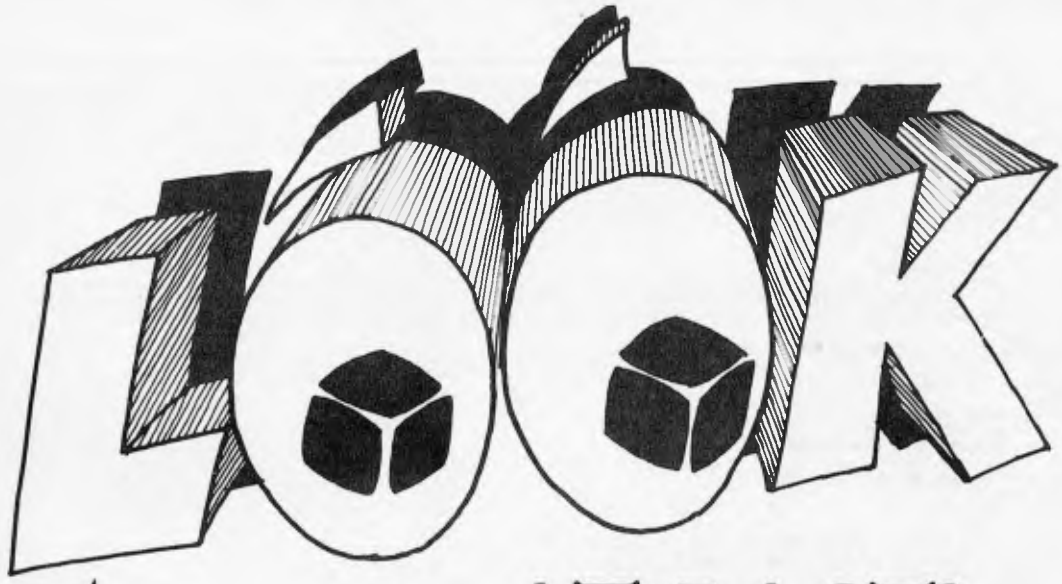
```
1  REM   *     SIMON SAYS     *
2  REM   *         BY         *
3  REM   *      R.C.BAKER     *
4  REM   *       C.1983       *
5  HOME : VTAB (5): PRINT  TAB( 15)"SIMON SAYS": PRINT  TAB( 15)"===== ====="
6  VTAB (20): PRINT "YOU MUST FOLLOW SIMON'S SEQUENCE OF": PRINT : PRINT "LIGHTS AND SOUNDS TO WIN!!"
7  FOR A = 1 TO 5000: NEXT : GOSUB 10100
10  DIM X(40):          LC =  - 16290:LO =  - 16289:B1 =  - 16287:B2 =  - 16286:B3 =  - 16285
12  DEF  FN A(X) = 2 * (X - 1)
13 CL = 49264
15  FOR A = 1 TO 4: POKE LC -  FN A(A),0: NEXT
20  HOME : PRINT "SIMON SAYS USES THE APPLE SWITCH UNIT.": PRINT : PRINT "BUTTONS A, B, AND C DETERMINE THE SPEED": PRINT : PRINT "AND SEQUENCE LENGTH - A IS SLOWEST/"
21  PRINT : PRINT "SHORTEST, AND C THE FASTEST/LONGEST ": PRINT : PRINT "TO START THE GAME, PRESS EITHER A, B, OR": PRINT "C WHEN THE RED 'LENGTH?' LAMP COMES ON"
22  PRINT : PRINT "AND THEN AGAIN WHEN THE YELLOW 'SPEED?'": PRINT : PRINT "LAMP COMES ON.  THE GREEN LAMP WILL THEN": PRINT "COME ON,  WHICH MEANS THAT YOU "
23  PRINT : PRINT "GOOD LUCK!"                                                    7 CAN START BY PRESSING A"
30  POKE LO - 6,0: GOSUB 250:LN = X * 10: POKE LC - 6,0
33  FOR X = 1 TO 500: NEXT
35  POKE LO - 4,0: GOSUB 250:G = X: POKE LC - 4,0
38  FOR X = 1 TO 500: NEXT
40  POKE LO,1: IF  PEEK (B1) <128 THEN 40
45 SPD = 255: POKE LC,0: FOR X = 1 TO 100: NEXT
50 SPD = 255:X =  INT ( RND (1) * LN): IF X <.5 * LN THEN 50
70  FOR A = 1 TO X
80 X(A) =  INT ( RND (1) * 5): IF X(A) <1 OR X(A) >4 THEN 80
90 A$ = A$ +  STR$ (X(A)): NEXT
100  FOR A = 1 TO  LEN (A$):SPD = SPD - G * 3
110  FOR B = 1 TO A:C =  VAL ( MID$ (A$,B,1))
120  POKE LO -  FN A(C),1: POKE 769,SPD: POKE 768,C * 20 + 100: CALL 770: POKE LC -  FN A(C),0
130  NEXT B: FOR B = 1 TO A:C =  VAL ( MID$ (A$,B,1)): POKE  - 16368,0
140  POKE CL,0: IF  PDL (3) >250 THEN 140
142  POKE CL,0:Z =  PDL (3)
144  IF Z <30 THEN Z = 4: GOTO 150
145  IF Z <60 THEN Z = 3: GOTO 150
146  IF Z <110 THEN Z = 2: GOTO 150
147 Z = 1
150  IF Z = C THEN 200
160  POKE 768,240: POKE 769,250: CALL 770: HOME : PRINT "YOU GOOFED!!!!!"
165  PRINT : PRINT "YOU GOT TO NOTE ";A;" OUT OF "; LEN (A$)
170  VTAB (20): PRINT "DO YOU WANT ANOTHER GO? (Y) ";: POKE  - 16368,0: GET Z$
180  IF Z$ <>"Y" THEN  PRINT : PRINT  CHR$ (4);"RUN HELLO"
190  CLEAR : GOTO 10
200  POKE 768,C * 20 + 100: POKE 769,SPD: POKE LO -  FN A(C),1: CALL 770: POKE LC -  FN A(C),0
210  NEXT B: FOR Z = 1 TO 1000: NEXT : NEXT A
220  FOR X = 1 TO 10: POKE 768,80: POKE 769,20: CALL 770: POKE 768,120: POKE 769,20: CALL 770: NEXT
230  HOME : PRINT "YOU DID IT!!              WELL DONE!"
240  PRINT : PRINT "THE SEQUENCE LENGTH WAS ";A - 1: GOTO 170
250  IF  PEEK (B1) >127 THEN X = 1: RETURN
260  IF  PEEK (B2) >127 THEN X = 2: RETURN
270  IF  PEEK (B3) >127 THEN X = 3: RETURN
280  GOTO 250

10100  POKE 770,173: POKE 771,48: POKE 772,192: POKE 773,136: POKE 774,208: POKE 775,5: POKE 776,206: POKE 777,1: POKE 778,3: POKE 779,240: POKE 780,9: POKE 7 ,202
10110  POKE 782,208: POKE 783,245: POKE 784,174: POKE 785,0: POKE 786,3: POKE 787,76: POKE 788,2: POKE 789,3: POKE 790,96: POKE 791,0: POKE 792,0
10120  RETURN
```



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Components	Recommended supplier	Part number	
3-off Push Button Switch	RS Components	336-602	
4-off Illuminated Push Button Switch	Verospeed	63-22189L	Switch
	Verospeed	63-22199F	Pack 5 coloured inserts
	Verospeed	63-22511k	6 Volt Lamps
1-off Quad Opto-Isolator IC	Verospeed	89-21767C	
4-off BFX85 Transistor	RS Components	294-659	
7-off 1k Resistor, 5%	RS Components	131-255	Pack 10
8-off 10k Resistor, 5%	RS Components	131-378	Pack 10
1-off 820R Resistor, 5%	RS Components	131-249	Pack 10
1-off 47k Resistor, 5%	RS Components	131-457	Pack 10
1-off 82k Resistor, 5%	RS Components	131-485	Pack 10
1-off 22k Resistor, 5%	RS Components	131-413	Pack 10
1-off 6 Pin Din Socket	RS Components	478-295	
1-off 5 Pin 180° Din Socket	RS Components	478-273	
Veroboard	RS Components	433-826	
Case with or without Battery — To Suit			
Power Supply (Optional)			
1-off Mains Transformer, 9 Volt Secondary	Verospeed	89-21550D	
1-off Bridge Rectifier 50V Lamp	Verospeed	253-25508F	
1-off Zener Diode, 6.8 V, 500mW	Verospeed	253-26015H	
1-off TIP41 Transistor	RS Components	294-839	
1-off BC182L Transistor	RS Components	294-277	
1-off Resistor 22k 5%	RS Components	131-413	Pack 10
1-off Resistor 470R 5%	RS Components	131-211	Pack 10
1-off LED	RS Components	586-475	
1-off Capacitor, 1000 µf 25V	RS Components	103-610	

Fig 4 Components and suppliers. Note that the BFX85 transistor is available from Rod Irving Electronics. An equivalent to the BFX85 is a BSW66.

Pin	Function	Pin	Function
1	+5v from Apple power supply	9	no connection
2	PB0 Input	10	AN0 Output
3	PB1 Input	11	AB1 Output
4	PB2 Input	12	AN2 Output
5	not used by Switch Interfaced	13	AN3 Output
6	GC0 Input	14	GC3 Input
7	GC1 Input	15	GC1 Input
8	0v Ground connection	16	no connection

Fig 5 Pin-out's from Apple game I/O socket

cable is recommended to connect from the Apple to the switch unit. A complete list of components and a recommended supplier (and his type nos) is given in Fig 4. The pin-out numbers from the DIL socket are given in Fig 5, and the memory locations which relate to the inputs and outputs are given in Fig 6.

The outputs AN0-AN3 can be toggled on and off by an instruction such as POKE xxxx, 1 where xxxx is the appropriate memory location. The push button inputs

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by Veronika Megler & Philip Mitchell

Visit JRR Tolkien's Middle Earth with The Hobbit, the most amazing adventure yet devised for any microcomputer.

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Commodore 64
Your fighter is under attack by a formation of fighters who attack only when the formation is complete giving you a chance to wipe them out. The mother ship will form a convoy to attack or capture you with its laser traction beam. If captured the other fighter in your formation continues the battle and if he shoots down the mother ship the captured fighter is released and combines with the other fighter to create double firing capacity.

NEW

COSMONAUT
VIC 20 Unexpanded
You are a cosmonaut and your task is to free your spacecraft from the tractor beam which holds it in thrall on the barren planet. You must go with care, because almost all objects will electrocute you if you touch them — even your spaceship if it is held by the tractor beam. You can jump over obstacles, and move between levels by jumping onto the lifts which connect them. This fantastic new game works with joystick or keyboard and features moving elevators, stormtroopers, laser guns and more!

VIC 20 UNEXPANDED

MINI KONG
Kong has abducted a young maiden and has trapped her at the top of his lair. You have to climb the ladders and use the lift to rescue her.

FROGRUN
Dodge the fast moving traffic on the freeway, the frog-eating snakes and get the frogs across the river to the frog-holes alive.

DOTMAN
An exciting version of the arcade maze game in which you control the DOTMAN as he goes around the maze gobbling all the dots.

SLAP DAB
Sam, the little painter has been told to paint a very large area. As he paints, he disturbs the woodworms which come out of hiding and start chasing him.

TINY TOTS SEVEN
A fun games cassette which includes, Simon, 0's & X's, Bombs Away, Super Snap, Duck Shoot and Santa.

GAMES PACK (VOL. 1)
Includes Lunar Docker, Slalom, Bounce Out, Snake, Bomber, Memory and Othello.

CRAWLER
Armed with a laser cannon in a mushroom garden you must fend off the crawly centipedes, spiders and fleas.

FOR THE VIC 20 16K

KRAZY KONG
Kong has abducted a young maiden and trapped her at the top of his lair. You have to climb the scaffolding and ladders to rescue her.

PHARAOH'S TOMB
The Pharoah's Tomb abounds with evil. Death will stalk you on your quest for the key which has the power to end the reign of evil.

THE DUNGEONS
Enter the fantasy world populated by ferocious monsters and a fire breathing red dragon that would deny you possession of the magic basket containing the secrets of the LOWER DUNGEONS.

3D TIME TREK
You are the only survivor of the planet 'Corillian' and have vowed to destroy those responsible for the destruction of your planet and rid the galaxy of the alien tyranny.

ZOK'S KINGDOM
When your starship encounters a meteor storm it is forced to crash land on the nearest planet which is ruled by Zok, a distant relative of Dracula. Dare you enter his kingdom.

XENO II
A space thriller to delight all arcadians. This game has four action packed stages and your mission is to destroy the power sources of XENO II.

GALACTIC ABDUCTOR
Your defenceless satellites are under relentless attack by ferocious armoured space hawks. An exciting arcade game with brilliant graphics and unusual sound effects.

FOR COMMODORE 64 & VIC 20

FROGRUN

In this game you have to get five frogs from the bottom of the screen to their frog-holes at the top of the screen. Unfortunately, this is not all that easy, because first you have to dodge the fast moving cars and lorries on the freeway, then the hungry frog-eating snakes on the river banks and then you must hop on the logs, crocodile's tails and turtles to get to the frog-holes.

KONG

Kong has abducted the beautiful starlet FAY RAY and has trapped her in his lair. There are four screens, as soon as you finish one screen, Kong removes FAY RAY to the next level. You have to finish all four screens and destroy KONG's lair before you can rescue the beautiful lady.

SKRAMBLE

In the year 2184, after years of constant bombardment, the planet earth has been taken over by Cobrons who have now departed but left the government in the hands of super intelligent command module. It requires a steady hand and accurate control to guide the fighter plane that has undertaken the suicidal mission of destroying the base!

HEXPERT

Bert is a small, charming furry creature who has been captured by an evil witch who forced him to play on her games pyramid. This three dimensional pyramid is constructed from hexagons. Bert has to change the top faces of all the hexagons to different colours by jumping from one face to another avoiding the rubber balls and snakes.

MOON BUGGY

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−16295	Turns	AN0	Off	When Referenced
−16294	Turns	AN1	On	When Referenced
−16293	Turns	AN1	Off	When Referenced
−16292	Turns	AN2	On	When Referenced
−16291	Turns	AN2	Off	When Referenced
−16290	Turns	AN3	On	When Referenced
−16289	Turns	AN3	Off	When Referenced
−16287	PB0 :	If button A pressed, value will be > 127		
−16286	PB1 :	If button B pressed, value will be > 127		
−16285	PB2 :	If button C pressed, value will be > 127		
−16284	GC0 :	Value from 0 to 255		
−16283	GC1 :	Value from 0 to 255		
−16282	GC2 :	Value from 0 to 255		
−16281	GC3 :	Value from 0 to 255		
−16272	Analogue input strobe — reference time location to reset inputs GC0~GC3			

Fig 6 Memory locations associated with game I/O

PB0 PB2 can be 'tested' by the instruction IF PEEK (xxxx) > 127 then yyy, whereupon the branch to yyy will occur if the button is being pressed. The analogue inputs can be referenced by PDL (x) Basic command, x being 0, 1, 2, or 3. It is worth resetting the 'Analogue Clear' location −16272 before reading a game controller, by issuing the command X = PEEK (−16272). A number of game programs will be published which use the game interface unit in future issues.

Given here is a demonstration program using the Apple switch unit described above. The program is the old Simon game which tests your reflexes and short-term memory retention by asking you to memorise and mimic a random sequence of lights and sounds. Instructions are contained within the program.

END

Z80:READ ONLY SECRETS

A good way to further your knowledge of machine code programming (which to many of us means learning the first principles) is to examine the instructions in a computer's read only memory or ROM. Geoff Lohrere, a specialist on the Z80 processor has written a disassembler for the Z80 based TRS-80/System 80 micro which, with a bit of perseverence can be used to lay bare the secrets of other Z80 based micros.

The program accompanying this article is a Z80 disassembler written for the TRS-80/System 80 micro. It should be easy to convert to most other Z80 based micros. The main purpose of a disassembler program is to convert machine code (possibly back) to assembler instructions. Machine code is a set of numeric instructions that the processor (Z80) can directly execute as a program. These numeric instructions usually take the form of a list of bytes in computer memory and can be very difficult to program without making numerous mistakes. To overcome this problem it is usual to use a substitute code known as the assembler language of the processor. This assembler language is far more meaningful from a programmer's point of view. For example, the hexadecimal (HEX) form of the machine code to load the Z80 C register with the value 24 (HEX) would be in two bytes OE 24. This is represented in assembler language as LD C,24H (LD for LOAD) which is far more meaningful to us.

To convert the assembler language instructions to machine code we would use an assembler program. If however we have machine code instructions available such as in the ROM of the computer, we can convert these to assembler language instructions by using a disassembler program and discover what the code does.

The assembler language of the Z80 processor consists of a set of instructions that can be split into three parts: the mnemonic; the first field operation code or 'opcode'; and the second field 'operand'.

In the above example LD is the mnemonic, C is the first field and 24H is the second field or OE is the opcode indicating to the Z80 a value has to be loaded into the C register, and 24H is the operand the value to be loaded. Some instructions only have the mnemonic, for instance RLA (Rotate Left Accumulator), and some only have the mnemonic and the first field, for instance INC H (increment the H register). The missing fields can be thought of as being empty. The disassembler works by forming these three fields and putting them together. The number of bytes of machine code needed to completely form the instruction varies for different instructions as for another example, LD A, (4000H), (Load the A register with the contents of memory location 4000H). The brackets around the Hex value 4000H, mean 'the contents of'. LD is the mnemonic, A is the first field, and (4000H) is the second field. The machine code bytes for this instruction are 3A, 00,40. 3A is the opcode, and 4000H is the operand. The least significant and most significant bytes of an address or 16 bit value are stored in memory in the order of least significant followed by most significant. With a bit more perseverence, the average person can quite easily learn the deep dark secrets of Z80 machine code. Happy disassembling!

Using the program

Utilizing this program is very straight forward. When RUN, the program will simply ask for a start and end address. These should be input as a one to four digit Hex address. On entering the end address the program will display each address in decimal and hex, followed by the hex and ASCII contents of that address, and then the opcode and operand. The byte or bytes of the operand if present will be displayed on the next line or lines with their decimal address. At the end of each displayed page you will be prompted for 'Spacebar' to continue, or 'Newline or Enter' to start a fresh disassembly.

```
10 DEFSTRB,F-H:Q1=65536:GOTO100
20 Z=0:IFLEN(A$)<4THENA$=STRING$(4-(LEN(A$)),0)+A$
30 A1$=LEFT$(A$,1):GOSUB80
40 Z=V¥4096:A1$=MID$(A$,2,1):GOSUB80
50 Z=Z+(V¥256):A1$=MID$(A$,3,1):GOSUB80
60 Z=Z+(V¥16):A1$=RIGHT$(A$,1):GOSUB80
70 Z=Z+V:RETURN
80 IFASC(A1$)<58THENV=VAL(A1$)ELSEV=(ASC(A1$)-55)
90 RETURN
100 CLS:PRINT"* * *  Z80 DISASSEMBLER  * * *":PRINT:INPUT"Start Address (SSSS)"
A$:GOSUB20
```

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```
110 Y=Z-4:X=4:INPUT"End Address (EEEE)";A$:GOSUB20
120 E=Z:GOSUB150:GOTO180
130 PRINT"SPACEBAR To Continue - NEWLINE Or ENTER To Return";
140 K$=INKEY$:IFK$=""THEN140ELSEIFK$=CHR$(13)THEN10ELSEIFK$<>" "THEN140
150 CLS:W=0:PRINT
160 PRINT"  ADDRESS","CONTENTS","OPCODE","OPERAND"
170 PRINT" DEC    HEX","HEX  ASCII":RETURN
180 IFE<Y+XTHENPRINTTAB(16)"END":GOSUB130ELSE200
190 GOTO10
200 Y=Y+X:P0=Y:P1=Y+1:P2=Y+2:P3=Y+3
210 IFP0>32767THENP0=-1*(Q1-P0)
220 IFP1>32767THENP1=-1*(Q1-P1)
230 IFP2>32767THENP2=-1*(Q1-P2)
240 IFP3>32767THENP3=-1*(Q1-P3)
250 ONXGOTO260,270,280,290
260 J=K:K=L:L=M:M=PEEK(P3):B=F:F=G:G=H:A=M:GOTO300
270 J=L:K=M:L=PEEK(P2):M=PEEK(P3):B=G:F=H:A=L:GOTO300
280 J=M:K=PEEK(P1):L=PEEK(P2):M=PEEK(P3):B=H:A=K:GOTO300
290 J=PEEK(P0):K=PEEK(P1):L=PEEK(P2):M=PEEK(P3):A=J
300 GOSUB360
310 ONXGOTO350,340,330
320 B=Z$:A=K:GOSUB360
330 F=Z$:A=L:GOSUB360
340 G=Z$:A=M:GOSUB360
350 H=Z$:GOTO480
360 Z$="":IFA<=255THEN390ELSEIFA<=4096THEN380
370 C=INT(A/4096):A=((A/4096)-C)*4096:GOSUB410
380 C=INT(A/256):A=((A/256)-C)*256:GOSUB410
390 C=INT(A/16):A=((A/16)-C)*16:GOSUB410
400 C=A
410 IFC<=9C$=STR$(C)ELSEC$=CHR$(C+55)
420 Z$=Z$+RIGHT$(C$,1):RETURN
430 IFK=>127THENK=K-256
440 IFK<0THEN450ELSEPRINT"+";
450 PRINTK;:RETURN
460 IFL=>127THENL=L-256
470 IFL<0THENRETURNELSEPRINT"+";:RETURN
480 X=1:A=Y-DI:GOSUB360
490 PRINTY;TAB(8)Z$,B;"  ";:IFJ<=191ANDJ=>32THENPRINT"("CHR$(J)")",;ELSEPRINTTAB
(32);
500 IFJ<>253THEN520ELSEIFK<>203THEN510ELSEX=4:ON(M/64)+1GOTO1350,1690,1700,1710
510 IFJ<>253THEN520ELSEIFK<=57THENX=2:GOTO1280ELSEX=3:IFK<=110THEN1650ELSEIFK<=1
19THEN1670ELSE1320
520 IFJ<>237THEN530ELSEX=2:GOTO1200
530 IFJ<>221THEN540ELSEIFK<=57THENX=2:GOTO1100ELSEIFK=203ANDM=>6THENX=4:ON(M/64)
+1GOTO1180,1620,1630,1640,ELSEIFK<=110ANDK=>70THENX=3:GOTO1580ELSEIFK<=119ANDK=>
112THENX=3:GOTO1600ELSEIFK<=249ANDK=>126THENX=3:GOTO1140
540 IFJ<>203THEN550ELSEX=2:IFK<=63THENON((K/8)+1)GOTO1480,1490,1500,1510,1520,15
30,1720,1540ELSEON((K-63.9)/64)+1GOTO1550,1560,1570
550 IFJ<=63THEN840ELSEIFJ<=127THEN1370ELSEIFJ=>192THEN990ELSEON((J-120)/8)GOTO14
00,1410,1420,1430,1440,1450,1460,1470
560 GOTO1720
570 ONNGOTO590,600,610,620,630,640,650,660
580 ONNGOTO670,680,690,700,710,720,730,740
590 PRINT"B,";:RETURN
600 PRINT"C,";:RETURN
```

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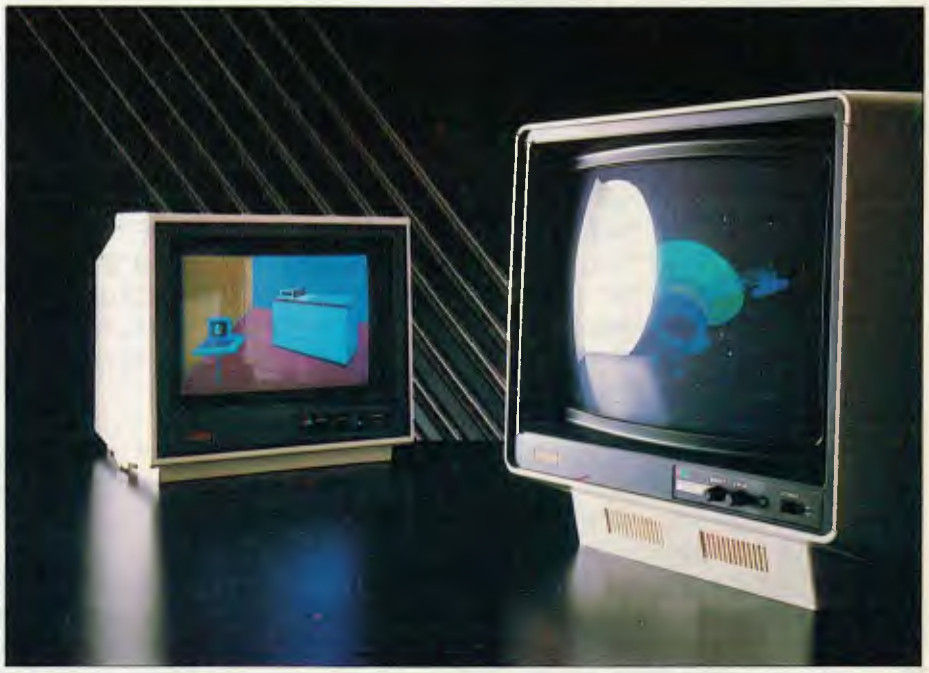

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```
610 PRINT"D,";:RETURN
620 PRINT"E,";:RETURN
630 PRINT"H,";:RETURN
640 PRINT"L,";:RETURN
650 PRINT"(HL),";:RETURN
660 PRINT"A,";:RETURN
670 PRINT"B":GOTO1720
680 PRINT"C":GOTO1720
690 PRINT"D":GOTO1720
700 PRINT"E":GOTO1720
710 PRINT"H":GOTO1720
720 PRINT"L":GOTO1720
730 PRINT"(HL)":GOTO1720
740 PRINT"A":GOTO1720
750 PRINT"(IY";:GOSUB460
760 GOTO820
770 PRINT"(IY";:GOSUB460
780 GOTO830
790 PRINT"(IX";:GOSUB460
800 GOTO830
810 PRINT"(IX";:GOSUB460
820 PRINTL;"),";:RETURN
830 PRINTL;")":GOTO1720
840 IFJ=0PRINT"NOP"ELSEIFJ=1PRINT"LD","BC,"G+F"H":X=3ELSEIFJ=2PRINT"LD","(BC),A"
ELSEIFJ=3PRINT"INC","BC"ELSEIFJ=4PRINT"INC","B"ELSEIFJ=5PRINT"DEC","B"ELSEIFJ=6P
RINT"LD","B,"F"H":X=2ELSEIFJ=7PRINT"RLCA"ELSEIFJ=8PRINT"EX","AF,AF'"
850 IFJ=9PRINT"ADD","HL,BC"ELSEIFJ=10PRINT"LD","A,(BC)"ELSEIFJ=11PRINT"DEC","BC"
ELSEIFJ=12PRINT"INC","C"ELSEIFJ=13PRINT"DEC","C"ELSEIFJ=14PRINT"LD","C,"F"H":X=2
ELSEIFJ=15PRINT"RRCA"
860 IFJ=16PRINT"DJNZ","$";:X=2:GOSUB430
870 IFJ=16PRINTELSEIFJ=17PRINT"LD","DE,"G+F"H":X=3ELSEIFJ=18PRINT"LD","(DE),A"EL
SEIFJ=19PRINT"INC","DE"ELSEIFJ=20PRINT"INC","D"ELSEIFJ=21PRINT"DEC","D"ELSEIFJ=2
2PRINT"LD","D,"F"H":X=2ELSEIFJ=23PRINT"RLA"
880 IFJ=24PRINT"JR","$";:X=2:GOSUB430
890 IFJ=24PRINTELSEIFJ=25PRINT"ADD","HL,DE"ELSEIFJ=26PRINT"LD","A,(DE)"ELSEIFJ=2
7PRINT"DEC","DE"ELSEIFJ=28PRINT"INC","E"ELSEIFJ=29PRINT"DEC","E"ELSEIFJ=30PRINT"
LD","E,"F"H":X=2ELSEIFJ=31PRINT"RRA"ELSEIFJ=32PRINT"JR","NZ,$";:X=2:GOSUB430
900 IFJ=32PRINTELSEIFJ=33PRINT"LD","HL,"G+F"H":X=3ELSEIFJ=34PRINT"LD","("G+F"H),
HL":X=3ELSEIFJ=35PRINT"INC","HL"ELSEIFJ=36PRINT"INC","H"ELSEIFJ=37PRINT"DEC","H"
ELSEIFJ=38PRINT"LD","H,"F"H":X=2ELSEIFJ=39PRINT"DAA"
910 IFJ=40PRINT"JR","Z,$";:X=2:GOSUB430
920 IFJ=40PRINTELSEIFJ=41PRINT"ADD","HL,HL"ELSEIFJ=42PRINT"LD","HL,("G+F"H)":X=3
ELSEIFJ=43PRINT"DEC","HL"ELSEIFJ=44PRINT"INC","L"ELSEIFJ=45PRINT"DEC","L":ELSEIF
J=46PRINT"LD","L,"F"H":X=2ELSEIFJ=47PRINT"CPL"
930 IFJ=48PRINT"JR","NC,$";:X=2:GOSUB430
940 IFJ=48PRINT
950 IFJ=49PRINT"LD","SP,"G+F"H":X=3ELSEIFJ=50PRINT"LD","("G+F"H),A":X=3ELSEIFJ=5
1PRINT"INC","SP"ELSEIFJ=52PRINT"INC","(HL)"ELSEIFJ=53PRINT"DEC","(HL)"ELSEIFJ=54
PRINT"LD","(HL),"F"H":X=2ELSEIFJ=55PRINT"SCF"
960 IFJ=56PRINT"JR","C,$";:X=2:GOSUB430
970 IFJ=56PRINTELSEIFJ=57PRINT"ADD","HL,SP"ELSEIFJ=58PRINT"LD","A,("G+F"H)":X=3E
LSEIFJ=59PRINT"DEC","SP"ELSEIFJ=60PRINT"INC","A"ELSEIFJ=61PRINT"DEC","A"ELSEIFJ=
62PRINT"LD","A,"F"H":X=2ELSEIFJ=63PRINT"CCF"
980 GOTO1720
990 IFJ=192PRINT"RET","NZ"ELSEIFJ=193PRINT"POP","BC"ELSEIFJ=194PRINT"JP","NZ,"G+
F:X=3ELSEIFJ=195PRINT"JP",G+F:X=3ELSEIFJ=196PRINT"CALL","NZ,"G+F:X=3ELSEIFJ=197P
```

```
RINT"PUSH","BC"ELSEIFJ=196PRINT"ADD","A,"F"H":X=2
1000 IFJ=199PRINT"RST","0H"ELSEIFJ=200PRINT"RET","Z"ELSEIFJ=201PRINT"RET"ELSEIFJ
=202PRINT"JP","Z,"G+F:X=3ELSEIFJ=204PRINT"CALL","Z,"G+F:X=3ELSEIFJ=205PRINT"CALL
",G+F:X=3ELSEIFJ=206PRINT"ADC","A,"F"H":X=2ELSEIFJ=207PRINT"RST","8H"
1010 IFJ=208PRINT"RET","NC"
1020 IFJ=209PRINT"POP","DE"ELSEIFJ=210PRINT"JP","NC,"G+F:X=3ELSEIFJ=211PRINT"OUT
","(C),A":X=2ELSEIFJ=212PRINT"CALL","NC,"G+F:X=3ELSEIFJ=213PRINT"PUSH","DE"ELSE
IFJ=214PRINT"SUB",""F"H":X=2ELSEIFJ=215PRINT"RST","10H"ELSEIFJ=216PRINT"RET","C"
1030 IFJ=217PRINT"EXX"ELSEIFJ=218PRINT"JP","C,"G+F:X=3ELSEIFJ=219PRINT"IN","A,"F
"H":X=2ELSEIFJ=220PRINT"CALL","C,"G+F:X=3ELSEIFJ=222PRINT"SBC","A,"F"H":X=2ELSEI
FJ=223PRINT"RST","18H"ELSEIFJ=224PRINT"RET","PO"ELSEIFJ=225PRINT"POP","HL"
1040 IFJ=226PRINT"JP","PO,"G+F:X=3
1050 IFJ=227PRINT"EX","(SP),HL"ELSEIFJ=228PRINT"CALL","PO,"G+F:X=3ELSEIFJ=229PRI
NT"PUSH","HL"ELSEIFJ=230PRINT"AND",""F"H":X=2ELSEIFJ=231PRINT"RST","20H"ELSEIFJ=
232PRINT"RET","PE"ELSEIFJ=233PRINT"JP","(HL)"ELSEIFJ=234PRINT"JP","PE,"G+F:X=3
1060 IFJ=235PRINT"EX","DE,HL"ELSEIFJ=236PRINT"CALL","PE,"G+F:X=3ELSEIFJ=238PRINT
"XOR",""F"H":X=2ELSEIFJ=239PRINT"RST","28H"ELSEIFJ=240PRINT"RET","P"ELSEIFJ=241P
RINT"POP","AF"ELSEIFJ=242PRINT"JP","P,"G+F:X=3ELSEIFJ=243PRINT"DI"
1070 IFJ=244PRINT"CALL","P,"G+F:X=3ELSEIFJ=245PRINT"PUSH","AF"ELSEIFJ=246PRINT"O
R",""F"H":X=2ELSEIFJ=247PRINT"RST","30H"ELSEIFJ=248PRINT"RET","M"ELSEIFJ=249PRIN
T"LD","SP,HL"ELSEIFJ=250PRINT"JP","M,"G+F:X=3ELSEIFJ=251PRINT"EI"
1080 IFJ=252PRINT"CALL","M,"G+F:X=3ELSEIFJ=254PRINT"CP",""F"H":X=2ELSEIFJ=255PRI
NT"RST","38H"
1090 GOTO1720
1100 X=2:IFK=9PRINT"ADD","IX,BC"ELSEIFK=25PRINT"ADD","IX,DE"ELSEIFK=33PRINT"LD",
"IX,"H+G"H":X=4ELSEIFK=34PRINT"LD","("H+G"H),IX":X=4ELSEIFK=35PRINT"INC","IX"ELS
EIFK=41PRINT"ADD","IX,IX"ELSEIFK=42PRINT"LD","IX,("H+G"H)":X=4
1110 IFK=43PRINT"DEC","IX"ELSEIFK=52PRINT"INC",;:X=3:GOTO790ELSEIFK=53PRINT"DEC"
,;:X=3:GOTO790ELSEIFK=54PRINT"LD",;:X=4:GOSUB810
1120 IFK=54PRINT""H"H"ELSEIFK=57PRINT"ADD","IX,SP"
1130 GOTO1720
1140 IFK=126PRINT"LD","A,";ELSEIFK=134PRINT"ADD","A,";ELSEIFK=142PRINT"ADC","A,"
;ELSEIFK=150PRINT"SUB",;ELSEIFK=158PRINT"SBC","A,";ELSEIFK=166PRINT"AND",;ELSEIF
K=174PRINT"XOR",;ELSEIFK=182PRINT"OR",;ELSEIFK=190PRINT"CP",;
1150 IFK<=190GOTO790
1160 X=2:IFK=225PRINT"POP","IX"ELSEIFK=227PRINT"EX","(SP),IX"ELSEIFK=229PRINT"PU
SH","IX"ELSEIFK=233PRINT"JP","(IX)"ELSEIFK=249PRINT"LD","SP,IX"
1170 GOTO1720
1180 IFM=6PRINT"RLC",;ELSEIFM=14PRINT"RRC",;ELSEIFM=22PRINT"RL",;ELSEIFM=30PRINT
"RR",;ELSEIFM=38PRINT"SLA",;ELSEIFM=46PRINT"SRA",;ELSEIFM=62PRINT"SRL",;
1190 GOTO790
1200 IFK=64PRINT"IN","B,(C)"ELSEIFK=65PRINT"OUT","(C),B"ELSEIFK=66PRINT"SBC","HL
,BC"ELSEIFK=67PRINT"LD","("H+G"H),BC":X=4ELSEIFK=68PRINT"NEG"ELSEIFK=69PRINT"RET
N"ELSEIFK=70PRINT"IM","0"ELSEIFK=71PRINT"LD","I,A"ELSEIFK=72PRINT"IN","C,(C)"
1210 IFK=73PRINT"OUT","(C),C"ELSEIFK=74PRINT"ADC","HL,BC"ELSEIFK=75PRINT"LD","BC
,("H+G"H)":X=4ELSEIFK=77PRINT"RETI"ELSEIFK=80PRINT"IN","D,(C)"ELSEIFK=81PRINT"OU
T","(C),D"ELSEIFK=82PRINT"SBC","HL,DE"ELSEIFK=83PRINT"LD","("H+G"H),DE":X=4
1220 IFK=86PRINT"I+","1"ELSEIFK=87PRINT"LD","A,I"ELSEIFK=88PRINT"IN","E,(C)"ELSE
IFK=89PRINT"OUT","(C),E"ELSEIFK=90PRINT"ADC","HL,DE"ELSEIFK=91PRINT"LD","DE,("H+
G"H)":X=4ELSEIFK=94PRINT"IM","2"ELSEIFK=96PRINT"IN","H,(C)"
1230 IFK=97PRINT"OUT","(C),H"ELSEIFK=98PRINT"SBC","HL,HL"ELSEIFK=103PRINT"RRD"EL
SEIFK=104PRINT"IN","L,(C)"ELSEIFK=105PRINT"OUT","(C),L"ELSEIFK=106PRINT"ADC","HL
,HL"ELSEIFK=111PRINT"RLD"ELSEIFK=114PRINT"SBC","HL,SP"
1240 IFK=115PRINT"LD","("H+G"H),SP":X=4ELSEIFK=120PRINT"IN","A,(C)"ELSEIFK=121PR
INT"OUT","(C),A"ELSEIFK=122PRINT"ADC","HL,SP"ELSEIFK=123PRINT"LD","SP,"H+G"H":X=
4ELSEIFK=160PRINT"LDI"ELSEIFK=161PRINT"CPI"ELSEIFK=162PRINT"INI"
```

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look at this great range of educational, financial & games software

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Are you lost when it comes to computing? Try this – written just for you in a language you can understand. It'll have you conversant with Dick's VZ-200 computer in just a few days!

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First Book of Programs
Tried, trusted and true programs for your VZ-200. There's something for everyone – and remember, they're all written in BASIC so you can save these on cassette – you only have to key them in once!

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Further Programming
After mastering BASIC, what comes next? It's all in this book – moving graphics, using MODE(1), music and PEEK & POKE. As well as lessons, there are also 15 or so games which you're sure to enjoy.

Cat B-7208 ..... **$9.95**

VZ-200 Technical Manual
Want to get the most from your VZ-200? This technical manual explains all the ins and outs, ups and downs. For the real computer enthusiast or the beginner who wants to know more!

Cat B-7204 ..... **$9.50**

The Giant Book of Games
An exciting collection of some favourite computer games guaranteed to provide you with hours of fun. There's even a section devoted entirely to games ideas which you can convert into computer games.

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The brilliant personal computer

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With all the personal computers around these days, you're probably wondering which one is the best value.

Before you buy any computer, take a look at three things: its power (or usefulness), its back-up and its price/future.

The Dick Smith VZ-200 features an 8K Microsoft BASIC, PLUS an additional 8K 'enhancements'. Compare that to the Tandy MC-10! And it has 8K user memory inbuilt: compare that to the VIC 20!

The Dick Smith VZ-200 is backed, of course, by the Dick Smith Electronics organisation. Complete technical and service facilities, program development, etc— all guaranteed.

The Dick Smith VZ-200 sells for only $169 – the first personal colour computer in Australia to sell below $200! There are many other computers now being unloaded around this figure – but be careful! You could be buying an 'orphan'!

look at these exciting ways to expand your system

Low-Cost
Colour Monitor

Don't want to tie up the family's colour TV? This high quality, 36cm colour video monitor gives bright, crisp pictures — sound too! Cat X-1195.

$389

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AND INTERFACE!

A pair of sturdy, super-responsive joysticks that add a whole new dimension to action games! Cat X-7212. **$39.50**

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Get optimum performance from your VZ-200! How? By storing programs and data on this deluxe recorder! This Quality National Cassette Recorder is ideal: Works perfectly with the VZ-200. Cat. A-4093

value at **$55.00**

Want more memory? Just plug this in & you've got it!

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Printer Interface

Lets your VZ-200 talk to almost any Centronics-type printer. Top quality! Cat X-7210. **$49.50**

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Don't buy just a printer — here's a fantastic NEW 4-colour printer that's an X-Y plotter as well! Produce graphs, pie charts, printing in many different sizes and colours. It's all so easy to do, using simple commands in your BASIC programs! Cat X-7208 **$299**

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A690M

```
1250 IFK=163PRINT"OUTI"ELSEIFK=168PRINT"LDD"ELSEIFK=169PRINT"CPD"ELSEIFK=170PRIN
T"IND"
1260 IFK=171PRINT"OUTD"ELSEIFK=176PRINT"LDIR"ELSEIFK=177PRINT"CPIR"ELSEIFK=178PR
INT"INIR"ELSEIFK=179PRINT"OTIR"ELSEIFK=184PRINT"LDDR"ELSEIFK=185PRINT"CPDR"ELSEI
FK=186PRINT"INDR"ELSEIFK=187PRINT"OTDR"
1270 GOTO1720
1280 IFK=9PRINT"ADD","IY,BC"ELSEIFK=25PRINT"ADD","IY,DE"ELSEIFK=33PRINT"LD","IY,
"H+G"H":X=4ELSEIFK=34PRINT"LD","("H+G"H),IY":X=4ELSEIFK=35PRINT"INC","IY"ELSEIFK
=41PRINT"ADD","IY,IY"ELSEIFK=42PRINT"LD","IY,("H+G"H)":X=4
1290 IFK=43PRINT"DEC","IY"ELSEIFK=52PRINT"INC",;:X=3:GOTO770ELSEIFK=53PRINT"DEC"
,;:X=3:GOTO770ELSEIFK=54PRINT"LD",;:GOSUB750
1300 IFK=54PRINT""H"H":X=4ELSEIFK=57PRINT"ADD","IY,SP"
1310 GOTO1720
1320 IFK=126PRINT"LD","A,";ELSEIFK=134PRINT"ADD","A,";ELSEIFK=142PRINT"ADC","A,"
;ELSEIFK=150PRINT"SUB",;ELSEIFK=158PRINT"SBC","A,";ELSEIFK=166PRINT"AND",;ELSEIF
K=174PRINT"XOR",;ELSEIFK=182PRINT"OR",;ELSEIFK=190PRINT"CP",;
1330 IFK<=190THEN770ELSEX=2:IFK=225PRINT"POP","IY"ELSEIFK=227PRINT"EX","(SP),IY"
ELSEIFK=229PRINT"PUSH","IY"ELSEIFK=233PRINT"JP","(IY)"ELSEIFK=249PRINT"LD","SP,I
Y"
1340 GOTO1720
1350 IFM=6PRINT"RLC",;ELSEIFM=14PRINT"RRC",;ELSEIFM=22PRINT"RL",;ELSEIFM=30PRINT
"RR",;ELSEIFM=38PRINT"SLA",;ELSEIFM=46PRINT"SRA",;ELSEIFM=62PRINT"SRL",;
1360 GOTO770
1370 X=1:IFJ=118PRINT"HALT":GOTO1720ELSEPRINT"LD",;:N=(J-56)/8:GOSUB570
1380 N=(J-((INT(N)*8)+56))+1:GOTO580
1390 GOTO1720
1400 PRINT"ADD","A,";:N=J-127:GOTO580
1410 PRINT"ADC","A,";:N=J-135:GOTO580
1420 PRINT"SUB",;:N=J-143:GOTO580
1430 PRINT"SBC","A,";:N=J-151:GOTO580
1440 PRINT"AND",;:N=J-159:GOTO580
1450 PRINT"XOR",;:N=J-167:GOTO580
1460 PRINT"OR",;:N=J-175:GOTO580
1470 PRINT"CP",;:N=J-183:GOTO580
1480 PRINT"RLC",;:N=K+1:GOTO580
1490 PRINT"RRC",;:N=K-7:GOTO580
1500 PRINT"RL",;:N=K-15:GOTO580
1510 PRINT"RR",;:N=K-23:GOTO580
1520 PRINT"SLA",;:N=K-31:GOTO580
1530 PRINT"SRA",;:N=K-39:GOTO580
1540 PRINT"SRL",;:N=K-55:GOTO580
1550 PRINT"BIT",;INT((K-64)/8);",";:N=(K-((INT((K-56)/8)*8)+56))+1:GOTO580
1560 PRINT"RES",;INT((K-128)/8);",";:N=(K-((INT((K-120)/8)*8)+120))+1:GOTO580
1570 PRINT"SET",;INT((K-192)/8);",";:N=(K-((INT((K-184)/8)*8)+184))+1:GOTO580
1580 PRINT"LD",;:N=((K-69.9)/8)+1:GOSUB570
1590 GOTO790
1600 PRINT"LD",;:GOSUB810
1610 N=K-111:GOTO580
1620 PRINT"BIT",;(M-70)/8;",";:GOTO790
1630 PRINT"RES",;(M-134)/8;",";:GOTO790
1640 PRINT"SET",;(M-198)/8;",";:GOTO790
1650 PRINT"LD",;:N=((K-69)/8)+1:GOSUB570
1660 GOTO770
1670 PRINT"LD",;:GOSUB750
1680 N=K-111:GOTO580
1690 PRINT"BIT",;(M-70)/8;",";:GOTO770
1700 PRINT"RES",;(M-134)/8;",";:GOTO770
1710 PRINT"SET",;(M-198)/8;",";:GOTO770
1720 IFPOS(0)>0PRINTTAB(32)"NOT FOUND":X=1
1730 W=W+1:IFW=12GOSUB130
1740 IFX=>2THENW=W+1:PRINTY+1,F"  ";:IFK<=191ANDK=>32PRINT"("CHR$(K)")"ELSEPRINT
1750 IFW=>12GOSUB130
1760 IFX=>3THENW=W+1:PRINTY+2,G"  ";:IFL<=191ANDL=>32PRINT"("CHR$(L)")"ELSEPRINT
1770 IFW=>12GOSUB130
1780 IFX=>4THENW=W+1:PRINTY+3,H"  ";:IFM<=191ANDM=>32PRINT"("CHR$(M)")"ELSEPRINT
1790 IFW=12GOSUB130
1800 GOTO180
```

CHECKOUT

A LITTLE PRINT

Bill Davies looks at a new contender in the budget printing field — the Tandy TP-10.

Tandy's recently released TP-10 printer will interest anyone with an RS232 serial interface.

Not only is the TP-10 widely compatible, it is also cheap. $149.95 will buy you surprisingly good thermal print quality on 4.5 inch paper with 32 characters per line and it is ideal for the production of clear program listings.

Like most Tandy products it comes in a cardboard container with polystyrene supports. Enclosed with the machine is a power cord and a three pin plug.

One look at the instruction book will alert you to the fact that this is an economy machine. The well-written manual is A5 size instead of the normal A4 and contains only 27 pages.

The printer is small, 210mm x 150mm x 80mm, and weighs only 1.5kg. It has an off-white, rigid plastic case with a transparent smoked plastic hinged lid.

The TP-10 has the ability to print a 96 ASCII character set, plus 12 graphics characters. The 4.5in paper width restricts the print width to only 32 characters per line. The TP-10 has software-controlled access to character and graphics, elongation and repeat functions.

The printer has only a serial RS232 interface, but this shouldn't produce too many problems if your computer has the standard connections. Obviously, the machine is designed to interface with the Tandy computers — the new MC-10 or the older, larger Colour Computer.

The printer should work with many other popular computers with a suitable RS232 interface, so the machine won't be restricted to Tandy computer owners.

The printer's only controls are an on/off switch which is located at the side of the machine and a paper feed touch-sensitive button at the front. There is a power LED on/off indicator.

Loading paper into the TP-10 is fairly simple, although the manual points out some do's and dont's. It warns the user to feed the paper into the machine straight to avoid paper jams and that care must be taken in clearing a paper jam, since any paper remaining in the printer means disassembling the machine to clear it. The white heat-sensitive paper also has to be loaded the correct way round.

To load you must place the roll of paper in the printer, turn the power on, and then use the paper feed button first to feed on, and then to feed the paper through the slot and round the platen. Once in the machine, the paper is protected by a plastic top.

Switching on the power and pressing the paper feed at the same time will give you your first chance to see the character set.

The limitations of the 32 character width are immediately obvious, but the print is clear and easy to read. The characters produced by the machine are standard 5 x 7 dot matrix which gives you a normal ten characters per inch. The elongated character set is exactly double. The graphics set is made up of a 7 x 12 dot matrix, again with 32 characters per line. If a line contains both elongated and normal characters the printer will not split up an elongated character when it appears at the end of a line.

The printer is limited in its operations to those described above, so it only recognises limited printer control codes, line feed, carriage return, large/normal print graphics etc. Trying to send anything else only causes it to print out some spurious character.

The printing speed of 30 cps is a little slow, but it is unlikely that you will be using it for any serious application which may require a faster print speed. It is almost silent in operation.

Obviously the paper is heat sensitive. Many people must have been caught this summer because they left their printouts near a window and heat of the sun erased all their hard work. As yet no-one has come up with a solution to this.

The TP-10 is very good for limited printing: it's a godsend, for instance, if you don't want to invest in a more expensive, more sophisticated printer just for program listings.

Because it uses white paper the print is easy to read and its quality is good for the price. At $149.95 the TP-10 is very competitive, but be warned that the special paper rolls can prove expensive — at $5.95 for two rolls you could soon find yourself paying out lots of money.

Tandy's new small printer is ideal if your printing requirements are limited.

BENCHMARKS SUMMARY

Peter Rodwell presents a roundup of the Benchmark timings used when evaluating computer systems.

Once again it's time to present our Great Benchmarks Summary. As regular readers will know, ever since *APC* started back in May 1980 we have included Benchmark tests in our evaluation of computer systems and printed here is a list of all the resulting timings we have published.

Well, not quite all. The roundup in fact includes only those machines for which an entire set of timings could be obtained — several machines which we have tested have been unable to run all the Benchmark tests and as the table is sorted according to the average timings, these incomplete sets had to be excluded. Also, note that timings for some machines which have not been fully benchtested have been included for interest's sake.

It is important to stress that the *APC* Benchmarks should not be used as a final criterion for your choice of computer unless you are interested exclusively in running Basic programs as quickly as possible. Originally, when manufacturers produced their own Basic interpreters, and Basic was the only language available on micros, the benchmarks provided a valuable speed indication, both of the machine and of the Basic interpreter. Now, though, many computers — especially in the business category — run the same Basic (usually Microsoft Basic), and, with other things being constant, tend to show little true variation. Differences sometimes do occur and can usually be put down to one machine's CPU running at a faster speed than another or other technicalities to do with internal construction.

The fastest home machine ever tested remains the BBC with Acorn's new micro, the Electron, pushing its way into second place well above the VIC 20.

It could be reasonably argued that a more meaningful set of Benchmark programs could be devised, particularly to cover areas such as graphics plotting and disk access. In fact we did once have a set of disk benchmarks but the wide variations in the way different Basics handle disk access made these completely impractical. The ideal was to write and read a set number of records, each of a set length, but it proved impossible to arrive at a standard record length which could be applied to *every* machine. Likewise with graphics: the variations in the way Basics handle graphics, together with the vastly differing graphics capabilities of different machines, made this impractical.

One final note: this year we have placed each machine in one of three categories: Home, Business or Portable. H = Home B = Business P = Portable

```
100 REM   BENCHMARK 1
110 PRINT "S"
120 FOR K = 1 TO 100
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM   BENCHMARK 2
110 PRINT "S"
120 K = 0
130 K = K + 1
140 IF K  1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM   BENCHMARK 3
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K / K * K + K - K
150 IF K  1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM   BENCHMARK 4
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K / 2 * 3 + 5 - 5
150 IF K  1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM   BENCHMARK 5
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K / 2 * 3 + 4 - 5
150 GOSUB 190
160 IF K  1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM   BENCHMARK 6
110 PRINT "S"
120 K = 0
130 DIM M(5)
140 K = K + 1
150 A = K / 2 * 3 + 4 - 5
160 GOSUB 220
170 FOR L = 1 TO 5
180 NEXT L
190 IF K  1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM   BENCHMARK 7
110 PRINT "S"
120 K = 0
130 DIM M(5)
140 K = K + 1
150 A = K / 2 * 3 + 4 - 5
160 GOSUB 230
170 FOR L = 1 TO 5
180 M(L) = A
190 NEXT L
200 IF K  1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM   BENCHMARK 8
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K ^ 2
150 B = LOG(K)
160 C = SIN(K)
170 IF K  1000 THEN 130
180 PRINT "E"
190 END
```

BENCHMARK TIMINGS

Cat	Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
B	Olivetti M20	1.3	4.0	8.1	8.5	9.6	17.4	26.7	16.0	11.5
B	TI Professional	1.0	4.2	9.3	9.7	10.5	19.0	29.5	31.0	14.3
H	BBC Micro	1.0	3.1	8.2	8.7	9.1	13.9	21.4	51.0	14.6
B	Monroe 8820	2.1	4.2	9.9	10.5	11.0	20.1	32.0	33.0	15.4
B	Vector Graphic VIP	1.0	3.8	10.9	10.7	11.6	20.5	32.7	34.0	15.7
B	ACT Sirius 1 #	1.8	5.3	10.7	11.1	12.9	24.2	37.1	27.9	16.4
B	ACT Apricot	1.6	5.2	10.6	11.0	12.4	22.9	35.4	34.4	16.7
B	Hitachi MB16001	1.5	5.0	10.5	10.5	12.5	23.5	36.0	35.0	16.8
B	Sharp MZ80B	0.6	4.5	8.5	11.5	13.0	19.0	27.5	50.0	16.8
B	IBM Personal Computer	1.5	5.2	12.1	12.6	13.6	23.5	37.4	35.0	17.6
B	Sord M23 (compiled)	2.5	2.5	8.0	8.0	8.0	21.0	25.0	70.0	18.1
B	NEC APC (Compiled CBasic)	2.3	2.3	13.7	17.6	17.8	32.0	34.8	37.1	19.7
B	Osborne 01	1.4	4.4	11.7	11.6	12.3	21.9	34.9	61.0	19.9

H	Electron	1.1	4.0	11.1	11.8	12.4	18.7	28.7	72.5	20.0
B	Tandy TRS-80 Model II	1.0	5.0	13.0	13.0	14.0	23.0	35.0	60.0	20.5
B	Hewlett Packard HP125	1.7	5.0	12.5	12.5	14.0	26.0	40.0	60.0	21.5
B	Intertec Superbrain	1.6	5.2	14.0	13.9	14.8	26.3	43.2	56.0	21.9
B	Apple III	1.7	7.2	13.5	14.5	16.0	27.0	42.5	75.0	24.7
B	Oki if8000	2.2	6.4	16.8	16.8	17.9	31.8	50.7	57.0	25.0
B	Ohio Scientific Challenger C2 4P	1.4	7.8	15.0	16.5	17.8	27.0	39.5	75.0	25.0
B	Epson OX-10	2.3	6.4	15.8	15.8	16.5	31.9	52.9	65.8	25.9
B	Xerox 820	1.7	5.5	15.5	15.1	16.2	28.9	46.1	80.0	26.1
B	NEC PC 8001	1.7	8.3	18.1	17.8	18.6	29.5	49.2	70.0	26.7
H	Commodore VIC 20	1.4	8.3	15.5	17.1	18.3	27.2	42.7	99.0	28.7
B	Sord M23 (interpreted)	2.5	7.2	18.5	18.5	19.3	35.0	52.0	85.0	29.8
B	Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	107.0	30.4
B	Hewlett Packard HP85	1.8	3.8	16.3	16.5	17.7	30.0	44.8	127.0	32.2
H	Exidy Sorcerer	1.8	10.0	20.7	22.2	24.3	37.6	53.7	96.0	33.3
H	Sharp MZ80A	1.5	9.2	16.4	22.8	25.6	37.7	55.0	101.0	33.7
H	MicroBee	2.7	10.0	18.1	17.9	20.9	39.4	67.3	9.5(est)	33.9
H	Commodore CBM 8032	1.7	10.0	18.4	20.3	21.9	32.4	51.0	119.0	34.3
H	Commodore PET 2001	1.7	9.9	18.4	20.4	21.0	32.5	50.9	123.0	34.7
B	Compucolor II	2.0	10.9	22.4	23.9	25.7	38.7	55.2	102.0	35.1
H	Micro-Professor	2.8	11.0	19.5	21.3	25.0	40.2	61.5	110.6	36.5
H	Hewlett Packard HP86	3.0	5.2	19.4	18.8	20.4	36.5	56.5	134.0	36.7
P	Hewlett-Packard HP-75C	3.0	5.0	22.1	21.8	24.3	40.0	57.3	139.0	39.1
H	Hitachi Peach	2.0	11.0	26.0	26.0	27.0	46.0	78.0	100.0	39.5
B	Panasonic JD700	2.8	9.1	24.6	24.7	26.2	43.9	69.7	118.0	39.9
H	Tandy TRS-80 Color Computer	2.0	11.3	22.2	23.9	27.0	41.5	61.1	130.0	39.9
H	Tandy TRS-80 Model I Level II	2.7	11.6	28.0	28.5	31.3	51.9	81.0	117.0	44.0
H	System 80	2.7	11.6	28.0	28.5	31.3	51.9	81.0	117.0	44.0
B	Cromemco System Three	1.7	4.6	14.9	17.8	19.4	30.2	41.9	229.0	44.9
B	Ohio Scientific Challenger C3 S1	1.7	13.1	21.6	23.7	29.2	39.6	58.3	176.0	45.4
H	Sinclair ZX81 (fast code)	4.5	6.9	16.4	15.8	18.6	49.7	68.5	229.0	51.2
P	Epson MX-20	2.7	15.3	33.1	32.8	35.3	59.1	100.6	133.3	51.5
H	Sinclair Spectrum	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253.0	58.5
H	Oric 1	2.0	17.3	29.4	31.7	38.1	50.1	76.1	233.4	59.8
P	Tandy TRS-80 Model 100	3.5	9.5	26.5	29.5	31.5	43.0	64.0	321.0	66.1
B	Sharp PC3201	4.0	13.5	35.5	35.5	38.5	67.0	108.0	250.0	69.0
B	Casio fx9000	2.5	9.0	24.0	24.0	26.0	42.0	60.0	365.0	69.1
B	Canon CX-1	3.0	6.0	21.0	23.0	24.0	41.0	54.0	390.0	70.3
H	Atari 400/800	2.3	7.4	19.9	23.2	26.8	40.7	61.5	431.0	76.6
H	Texas TI 99/4	2.9	8.8	22.8	24.5	26.1	61.6	84.4	382.0	76.6
H	Texas TI00/4A (standard)	3.0	9.0	24.0	24.8	26.2	61.9	84.6	384.0	77.2
H	Texas TI99/4A (extended)	6.5	18.5	40.0	40.1	42.0	98.4	140.3	240.0	78.2
P	Casio PB-100	8.0	39.0	82.0	80.0	105.0	160.0	220.0	341.0	129.4
P	Sharp PC1500	15.0	70.0	121.0	122.0	178.0	293.0	383.0	510.0	211.5
P	Sharp PC-1251	42.3	70.6	162.5	165.9	197.3	427.8	581.4	980.0	328.5

The original Sirius timings were taken using a pre-release version of Basic-80. Three timings have been taken with the production version of the interpreter.

LAZ G AROUND

Quickie

If you pay as much percentage income tax as you earn in dollars per week, what is the maximum take-home pay you can get? (For example, if you earn $100 per week, then income tax is 100% and take-home pay is nil.)

Prize Puzzle

The divisors of 66 are, 1, 2, 3, 6, 11, 22, 33 and 66. The sum of these is 144, which happens to be a perfect square.

I want you to find a 7-digit number with the same property — that is, the sum of whose divisors is a perfect square.

November Prize Puzzle

An average response for a puzzle which was not too difficult, but was ideal for solution by micro. Almost 90 entries, of which 8 came from overseas (not including New Zealand).

There were several correct solutions (ignoring the trivial solutions of 1, 2, 3, 4, 5 and 6), and I confess I had overlooked the smallest of these. There may be others, of course.

Base 10	Base 7	Base 9
31	43	34
248	503	305
731445	6134331	1334316
811518	6616641	1466166

Anyway, congratulations T Johnston — your prize will be forthcoming.

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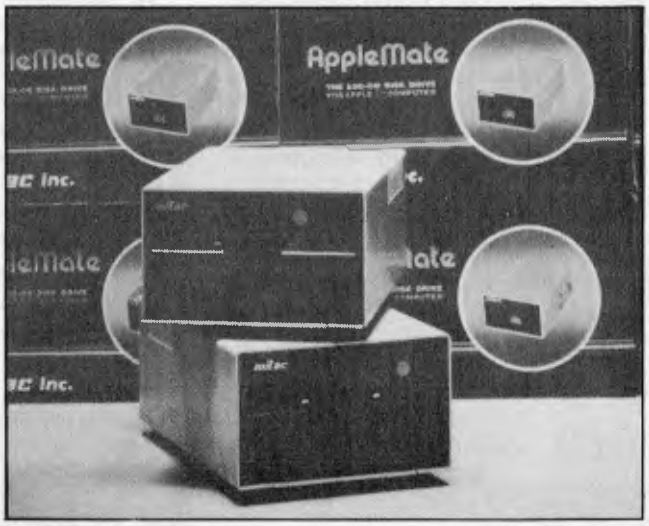

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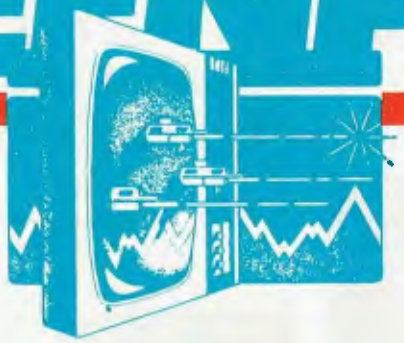


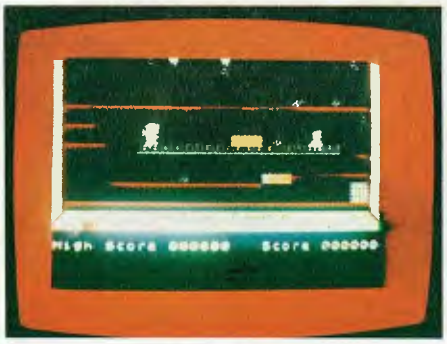
Ian Davies gives his verdict on games for the Sinclair Spectrum.

MANIC MINER

SUPPLIER: Computer Play
PRICE: $25.00

Manic Miner, sometimes also known as "Miner '49er", is probably the most delightful, engrossing and amusing non-violent game available on today's market.

Miner Willy goes exploring down an old mine shaft. He rambles from chamber to chamber, gathering the numerous keys necessary to advance to the next chamber. His peril takes the form of manic mining robots, poisonous pansies, spiders and slime. To further complicate matters, some of the floors are rotted through and may be walked over once but not continually stood upon or re-crossed. Willy is capable of walking left or right, and of executing a shoulder high jump, thereby allowing him to leap up to higher levels of the shafts.



To successfully negotiate a chamber, the player must cause Willy to jump over the poisonous pansies, over holes in the floor and over the roving robots. Sounds easy, doesn't it? It's not. A steadily diminishing air supply merely adds to your problems. Unfortunately, the precious keys are usually in difficult locations, such as suspended over a bad section of flooring just underneath a stalactite, or directly next to a pansy.

Willy meets his doom in numerous ways, always resulting in his repositioning to the bottom left hand corner of the screen. He has three lives, after which a large foot descends to squash him.

The game is of the highest quality construction, and is totally engrossing while still being non-violent. Manic miner is a must for all ZX-spectrum owners with 48K machines. It has justifiably won the game of the year award in the UK.

Use of graphics:	★★★★
Addictive quality:	★★★★★
Use of colour:	★★★★
Use of sound:	★★★
Game speed:	★★★★
Value for money:	★★★★★

LOCO

SUPPLIER: Multicomp Pty Ltd
PRICE: $22.00

Loco is a non-violent game based on the Rubik cube concept, and runs on 16K ZX-spectrums. The one page instruction sheet explains that the name is derived from the "locomotive" motif used in the game, and also the fact that it has been known to "drive people loco".

The action takes place on a square or rectangular grid, with three to five cells in each direction. The objective is to rotate columns and rows in order to reach a target

configuration. This proves to be very simple for a 3 x 3 matrix, but increasingly more difficult for larger sizes of matrix. The ability for loco to generate rectangular matrices adds an unusual twist. Further, nine levels of difficulty can be selected by the player.

The game may be interrupted at any point, at which time the player may opt to abandon, give up, reset or continue.

Loco certainly provides mental exercise, but could hardly be called thrilling or addictive. Rubik cube enthusiasts will no doubt take to it with great relish.

Use of graphics:	★★★
Addictive quality:	★★★
Use of sound:	★
Use of colour:	★★★
Value for money:	★

THE HOBBIT

SUPPLIER: Melbourne House
PRICE: $39.95

"The Hobbit" is a book by the classic author J.R.R. Tolkien, and preceeds his "Lord of the Rings", a major work known by many. The scene is set in the land of "Middle Earth, and major characters include Gandalf the wizard and Thorin the dwarf. You play the role of the Bilbo, the hobbit. Your mission is to seek out and destroy the evil dragon, taking his treasure. To provide a background, Melbourne House include a copy of the book with each software package.

This game is extolled as a "super-program that is a milestone in computer software" and "the most sophisticated natural language recognition program yet developed on any microprocessor". I feel that these statements are probably over doing things a trifle. The Hobbit is a souped-up "adventure" style game created in a classic setting and with a slightly better language input than the standard adventure, but it hardly constitutes a breakthrough in artificial intelligence.

The Hobbit is certainly challenging, and is supplied with adequate documentation describing their "INGLISH" language. Superb graphics adorn each scenario providing a computerised copy of the illustrations from the book. Facilities are also provided to log your movements to the ZX-printer, and to save your current game status to tape. Additionally, the Hobbit provider a "real time" aspect not found in normal adventure. In other words, situations will develop while you are deciding on your next move. A "pause" command is provided to suspend the game until any key is pressed.

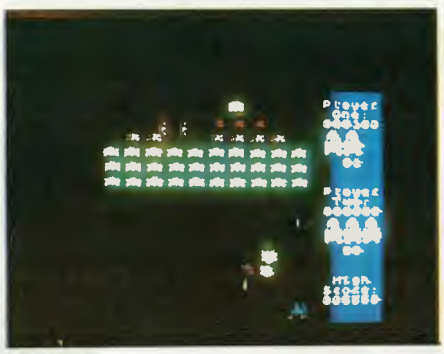
The "INGLISH" language is certainly an improvement on the trusty old adventure, allowing sentences such as "take the lamp and the rope out of the barrel". It can even resolve certain ambiguities by the use of adjectives, for example, "break all bottles except the green one". INGLISH is not, however, natural language. This quickly becomes clear as you play the game, as it is often necessary to grope for the correct means of expression. A little experience and the dictionary provided quickly eases this problem.

The Hobbit runs on 48K ZX-spectrums and should be popular with adventure devotees and Tolkien followers.

Use of graphics:	★★★
Use of sound:	★
Addictive quality:	★★★★
Game speed:	★★
Use of colour:	★★★
Value for money	★★★

GALAXIANS

SUPPLIER: Gametronics
PRICE: $22.00



Galaxians by Arctic Software is a particularly pleasing implementation of an arcade game favorite. A bank of standard space-invader types parade across the top of the screen and allow themselves to be shot at by you – the earth defender fearlessly positioned at the bottom of the screen without any shelter from their deadly bombs.

All good earth defenders know that the best defence is a relentless offence, and this is really the name of the game. With your laser cannon only shooting one round at a time, it is necessary to fire and then skillfully dodge the rain of fire until your shot has met its target, at which time you can proceed to send another galaxian to its doom. To make life more difficult, however, the galaxians tend to spiral down towards you - sometimes just one of them, sometimes three or four. As the game progresses, their attacks become more frequent and more accurate.

Points scored vary according to the height of the destroyed galaxian, and swooping galaxians yield double points. The game supports nine levels of difficulty and can be played in one or two player modes. High scores are retained, and each player has three lives before being fatally destroyed.

The keyboard provides controls to move left, right and fire the cannon. Additionally, the "A" button may be used to abandon the current game, or the "S" key can pause the action temporarily until any key is pressed to continue. Unfortunately, keyboard bounce often means that the game is paused and then immediately continued again, so you may need to be quick with the "S" key to really achieve a pause in the game.

Galaxians is a very challenging game, although hiding in either corner of the screen appears to be a safe tactic when the going gets tough. However, the hiding technique is not always safe, and players quickly learn not to rely on it.

The game runs on a 16K ZX-spectrum, and can utilise the Sinclair joystick. It makes excellent use of colour, graphics and sound, and runs with good game speed.

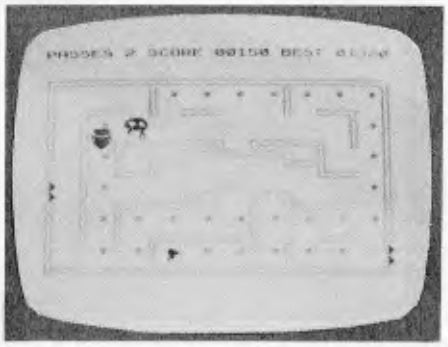
Use of graphics:	★★★★
Addictive quality:	★★★★
Use of colour:	★★★
Use of sound:	★★★★
Game speed:	★★★★
Value for money:	★★★★★

HUNGRY HORACE

SUPPLIER: Melbourne House
PRICE: $20.00

Hungry Horace is a well implemented re-make of the good old "Paeman" theme. Produced by Psion Software in association with Melbourne House, and running on a 16K ZX-spectrum, the game offers the traditional Paeman objectives in a totally new setting.

The action all takes place in a park, and Horace's job (under your direction) is to eat as many flowers as possible from the paths running throughout the park. Alas, the parks' guard will chase Horace and attempt to catch him before he eats too many flowers. In his mad dash, the guard sometimes drops part of his lunch (specifically cherries and strawberries), the eating of which will earn Horace an extra 100 points, ten times that of the lowly flowers.



Horace can extract his gleeful revenge by eating one of the alarm bells. This throws the guard into a panic, at which time he can be eaten for bonus points. Leaving your vicious attack too long will result in the addition of extra park guards, thereby making it increasingly more difficult to navigate the paths without being caught. Horace may be caught three times before the game is brought to a close.

Each screen includes at least two exits and/or entrances, some of which lead onto the opposite side of the same screen, and others lead onto completely different sceneries. Judicious use of these exits can save Horace from imminent capture, but may well result in him being delivered into an even worse situation.

Movement control is via the Q, Z, I and P keys which, while unusual, becomes very effective after a small amount of continued usage. Graphics is used to good effect, although screen contrast could be improved (see photo). Horace includes sound effects and the game speed is more than adequate. In summary, another good implementation of Paeman.

Use of graphics:	★★★
Addictive quality:	★★★★
Use of colour:	★★
Use of sound:	★★★
Game speed:	★★★★
Value for money:	★★★★

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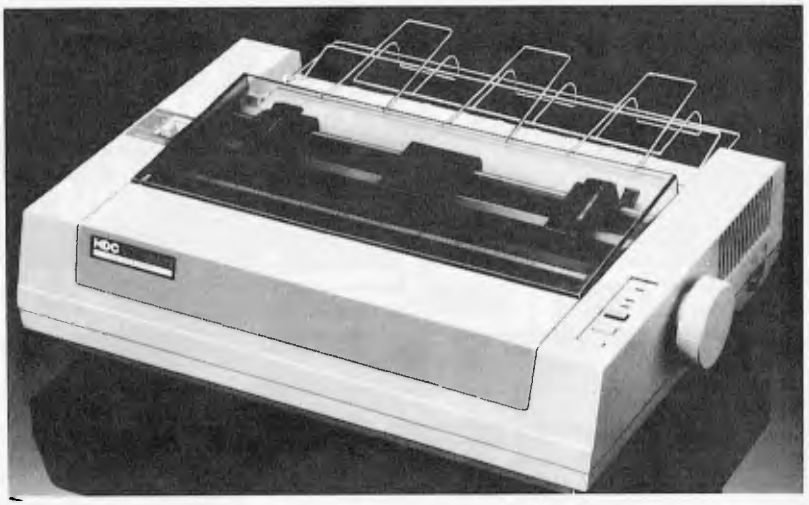

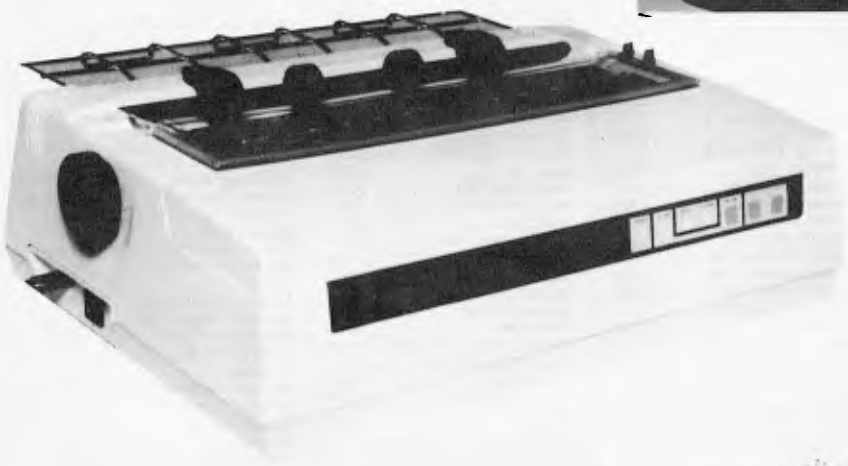

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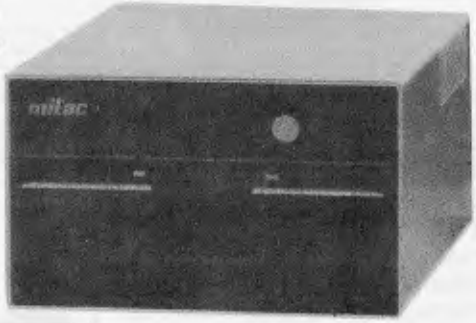

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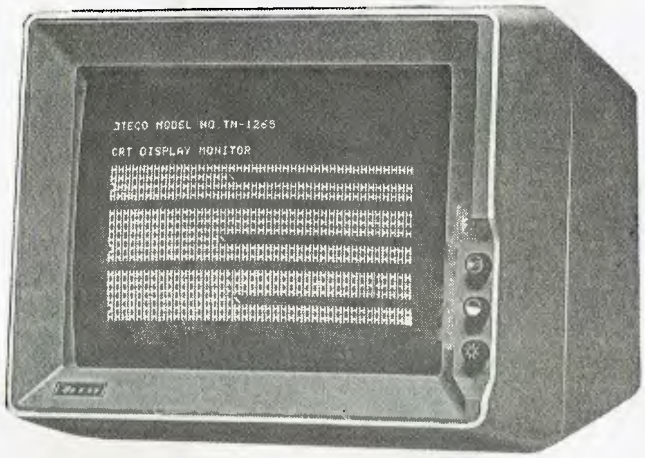

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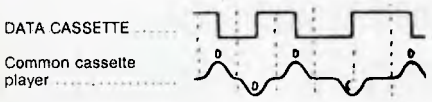

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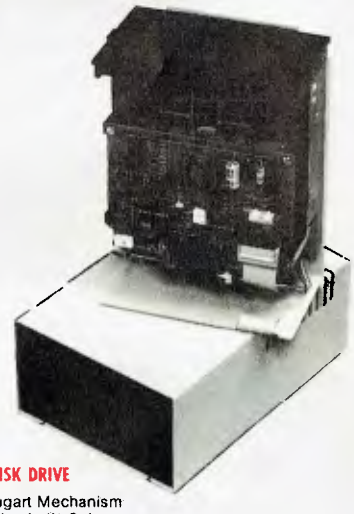

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DEALER ENQUIRIES WELCOME

YANKEE DOODLES

IBM PC Junior under scrutiny . . . personal computers made more user-friendly by new Visicorp package . . . unauthorised use of computers investigated by FBI . . . Sol Libes reports from Stateside.

Random rumours

Commodore is rumoured negotiating with Mark Williams Company, Chicago, Illinois, to use the latter's Unix-like Coherent operating system on Commodore's Z8000-based, 16-bit microcomputer now in development. The minimum system is expected to include 128k of RAM and a 320k disk drive amd sell for under $800. An 8088 plug-in card option is also expected . . . Commodore is also rumoured to be preparing a portable computer employing a 16 line by 80 character liquid crystal display and wafer-tape drive . . . Texas Instruments is rumoured working on a 68000 processor card with Unix-type operating system for its desktop IBM PC compatible system . . . IBM is rumoured to be preparing an optional Selectric-type keyboard for its PC . . . IBM is expected to make 1.2 million PC Junior home computers this year and is reportedly also preparing to introduce an enhanced PC Junior shortly which it expects will be even more popular than the unit recently introduced. There are rumours that it is getting parts quotations to build three million of these units over a one year period . . . Gavilan/Computer, which introduced its radically new portable computer last May, is not expected to start shipping until March, ten months after its introduction. The hang-up seems to be the software for its integrated operating system and applications software which utilises a mouse-like touch panel . . . Coleco is rumoured to be preparing a new, high-end system that will be upward compatible with its Adam system. This probably means that it will use a disk drive in place of its 'stringy floppy' . . . Morrow Designs is expected to announce transportable and portable machines compatible with the IBM PC . . . the first IBM PC clone from Taiwan is expected shortly from Multitech Electronics. It is already selling an Apple clone . . . North Star is expected to introduce a multi-user system compatible with the IBM PC that supports 12 users . . . There are rumours that IBM is to start building hard disk drives for the XT in house . . . Lotus Development Corp is rumoured negotiating to buy an as yet unannounced Pick-like operating system for the PC/XT . . . IBM is rumoured working on versions of the PC/XT as integrated data/voice workstations and PABX peripherals . . . IBM is expected shortly to start production of the PC and XT in Australia, adding a third plant to the two already in operation in Boca Raton, Florida and Greenock, Scotland . . . Mattel Inc, maker of the Aquarius home computer, is rumoured getting ready to follow in TI's footsteps and exit the home computer business . . . Bank of America is expected to announce a 'Personal Computer Account' for owners of home computers who want to conduct bank transactions using their systems and the phone lines. Open the account and it will deposit $24 to start it off. Fee will be $8 a month.

A look at IBM's PC Junior

The PC Junior is far from the least expensive home computer system on the market.

What it has going for it are those three magical letters on the front 'IBM'. And just as the PC/XT has become the *defacto* standard for office desktop systems, the PC Junior is expected to introduce a standard into the home/educational computer market where no compatibility currently exists. The lack of compatibility between systems is so bad that there is no compatibility between machines made by the same manufacturer (for example, Commodore, Atari, Apple). Thus the PC Junior's contribution to the home business market may be that it will finally bring some level of compatibility among software and peripheral products. It certainly offers nothing new in the way of technology or compatibility.

Companies who wish to compete at the upper end of the home computer market are expected to provide PC Junior compatibility. The companies who succeed here will be the ones who offer a lower cost combined with some additional value over what is offered on the PC Junior. Also, the success of PC Junior clones will depend to a great extent on IBM's ability to meet the market demand. One of the main reasons for the success of the PC/XT clones has been IBM's inability to catch up on demand.

Also, IBM is currently limiting distribution to its existing marketing channels. There is little doubt that later this year IBM will increase its distribution channels to mass marketing channels. It will be at this point that companies such as Commodore, Atari and Coleco will begin to feel the competition.

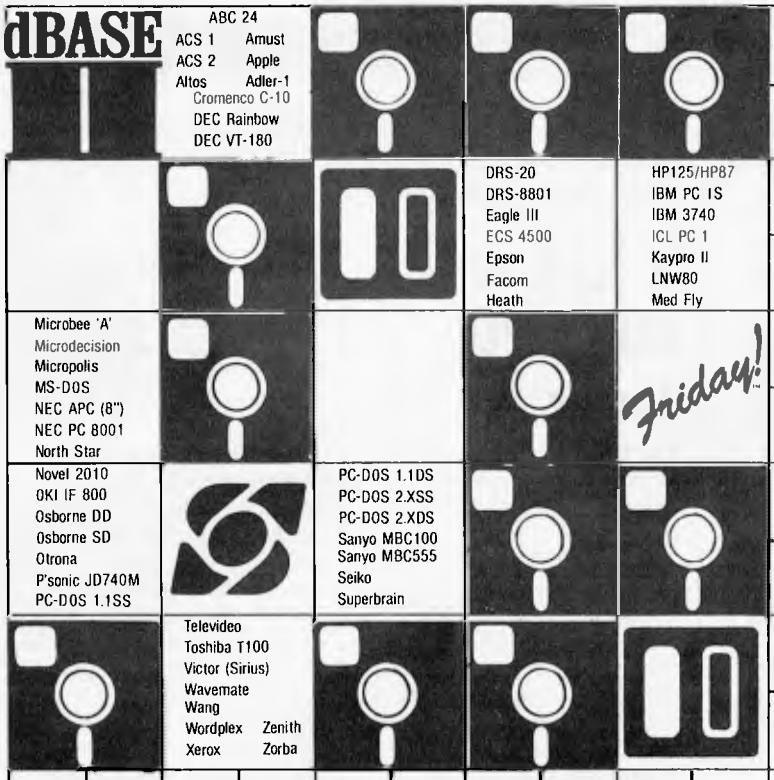
It is also expected that this year will see the Japanese entering the home computer market in the US with machines designed specifically for the US market. The Japanese have previously tried entering the US market with machines that have been very successful in the Japanese home market. These attempts have not met with success.

Apple news

There are also rumours that Apple will soon introduce a colour version of the Lisa computer as well as windowing and mouse capabilities for the II and III . . .and look for Apple to unveil a laser printer. It's also expected that Apple will standardise on the Sony type 3.5in disk drive for all future products.

Apple Computer and Rana Systems Inc have entered into an agreement to provide a disk add-on system for the Apple II which will provide IBM PC compatibility. The add-on will provide two 360k drives, an 8088 processor, 256k of RAM and the MS-DOS operating system for just under $2000. The success of this product is uncertain since it costs more than the Apple itself.

Apple's Elf transportable computer (rumoured in this column previously) should be announced by the time you read this. The unit is expected to use a 6500-type processor and will have a high level of Apple II compatibility. It should have



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64k of RAM expandable to 128k with some expansion slots on the motherboard. It will use a microfloppy drive and so the overall unit will be physically much smaller than the Apple II. RS232 and centronics ports are expected to be standard. A true battery operated portable CMOS version is expected soon.

Many Apple dealers reacted to the introduction of the IBM PC Junior by dropping the selling price of the Apple IIe to under $1000.

P-CP/M in beta test

Digital Research of Japan has disclosed that it's beta testing pre-production home computers using the new CP/M-in-ROM operating system. Reportedly, these units use an IC which integrates the system software ROM and processor into one IC, and will make possible the selling of CP/M-based systems for under $250. This version of CP/M is being referred to by DRI ad 'P-CP/M'.

Systems using P/CP/M are expected to compete with home computers using the new Microsoft MSX operating system. Several Japanese personal computer makers have already announced MSX based systems.

Radio Shack news

Radio Shack has introduced an IBM PC compatible computer called the Tandy 2000. It has 128k of RAM, half height drives that store twice as much as the IBM PC, twice the colours and pixel density, and it uses the 80186 microprocessor, running at almost twice the clock speed of the IBM PC's 8088 (the result is about four times the processing speed). Selling for $2750, it is over 20% less costly. One of the most surprising things is that on the day Radio Shack announced the unit, it was demonstrating it in its computer centres.

The Tandy 2000 is representative of the newer IBM PC clones that are coming to market, which are more powerful and faster than the IBM PC and thereby create some compatibility problems. It is expected that IBM will switch to the 80186 and an improved colour display controller for its PC/XT to meet competition. It is also expected that the 80186 will be in short supply and so may cause delivery problems for vendors using it throughout this year.

Large LCD Screen

Crystalvision, Sunnyvale, CA, is the first company to announce a flat panel LCD display device capable of displaying 25 lines by 80 characters. The company is promising that initial production quantities will be available this month at $345 in 1000 quantity lots.

The unit will have an 8in diagonal measurement (1in larger than the Osborne Executive) and store permanent images. Thus it will not have to be refreshed as do the current LCD displays. It will provide a pixel density of 640 x 250 (IBM PC has 640 x 200) and a nearly 90 degree viewing angle (currently LCD

YANKEE DOODLES

displays have a typical 20 degree viewing angle). The unit is less than 1in thick and is 10in x 7in overall. Crystalvision also claims that the contrast ratio is far better than current LCD displays.

This appears to be a significant jump over LCD devices shown at the recent Japan Electronics Show by Japanese companies, and may put the US back in the running in display technology.

New computer crime laws

The state of Wisconsin is working on a law that will make unauthorised destruction or alteration of computer records a felony, with a fine of up to $10,000 and 10 years in prison. Further, it outlaws computer programs that search through local telephone exchanges for computer dial-up tones, and bulletin board systems which include information on how to break into computer systems. About 20 other states already have laws on their books aimed at criminals who break into systems for financial gain, or who damage computer records.

Victor problems

Chuck Peddle, founder and president of Victor Technologies, has been 'relieved' of the operation of the company and assigned to product development. Chuck, for those who might not know, was the designer of the 6502 microprocessor and Commodore PET, the first integrated personal computer.

VT, founded only two years ago, now owes about $50 million and has laid off about half of its 2000 employees.

FBI traps computer intruders

The Federal Bureau of Investigation has begun investigating unauthorised use of computers using a 'trap and trace' technique. The FBI recently revealed that it had detected unauthorised use of the GTE Telenet system by trapping calls to a certain number and tracing their origin. Correlating this information with the time of the unauthorised entry into the system, it became the basis for the searching of homes around the country for other evidence of the computer break-in.

Random news bits

Apple has finally released the hardware/software package to allow its Lisa computer to access IBM, Digital Equipment and other computers. This fulfils a rumour which previously appeared here . . . Tandy has finally begun shipping CP/M for its Model IV computer, nine months after it was first announced . . . Panasonic, Sanyo, IT&T and Sperry have finally decided that they too have to jump into

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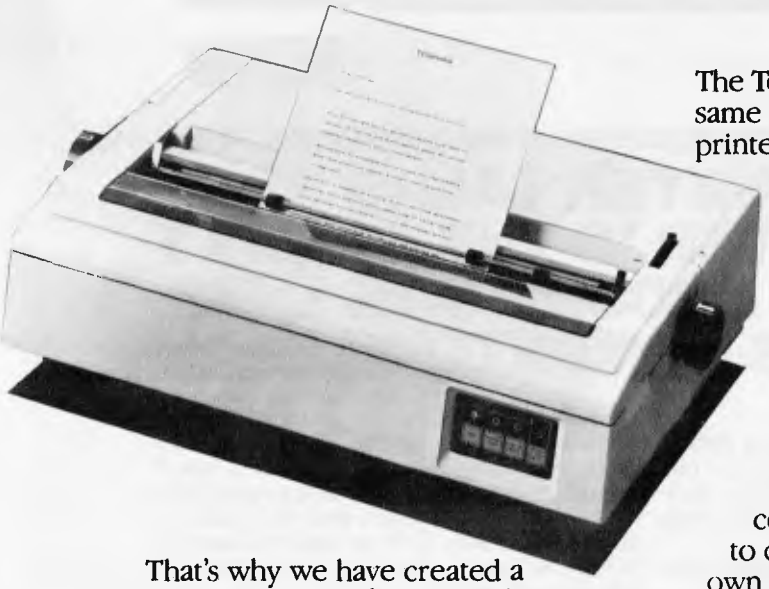

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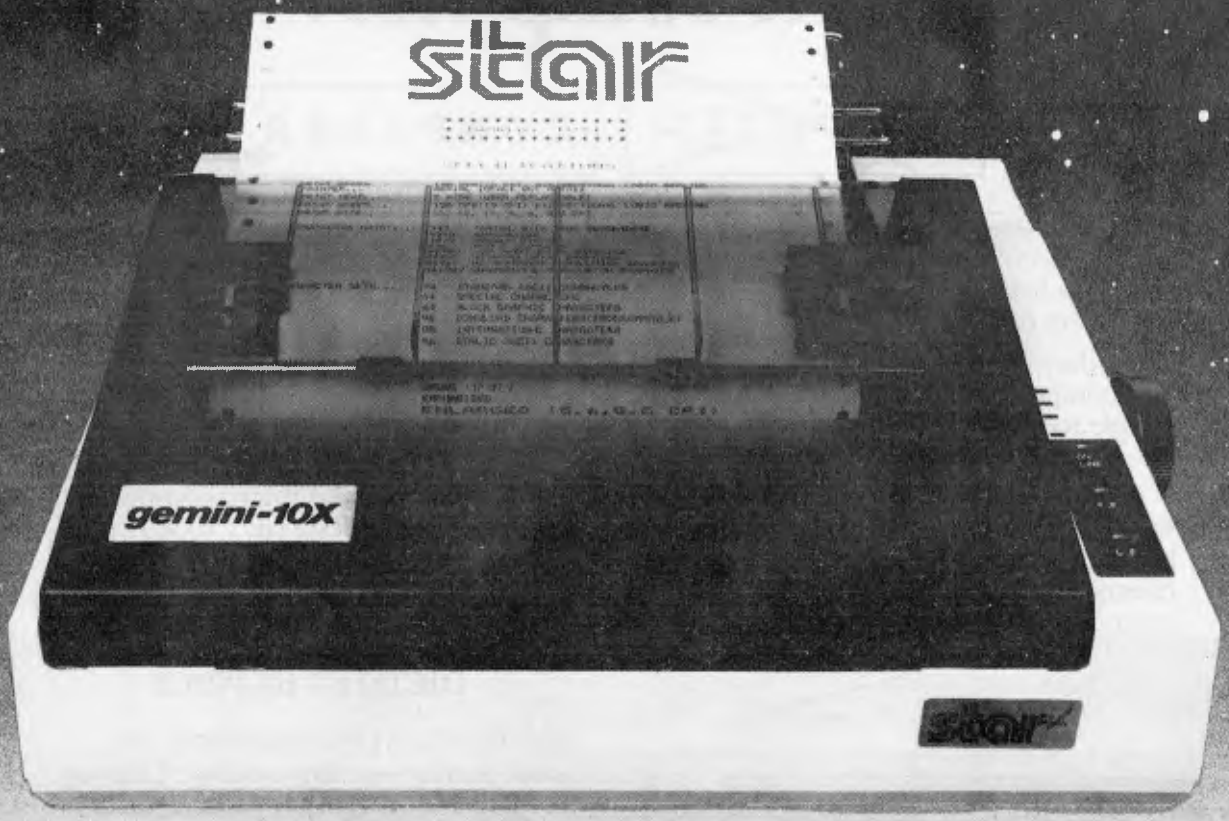

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the already crowded IBM PC compatible computer market (good luck!) . . . Digital Research has replaced Microsoft on a project to develop a Unix operating system for Intel's 80286 microcomputer . . . Apple is now offering a 30% discount to schools. IBM generally offers 20% off to schools.

16-bit version of 6502

When Commodore scrapped the 16-bit microprocessor it had been developing for several years in favour of the Zilog Z8000, it left the market wide open for an upward compatible 16-bit version of the 6502. And sure enough, a company has seized the opportunity. Western Design Centre Inc. Mesa, Arizona, has announced a 16-bit microprocessor that runs 6502 software, in an emulation mode, without revision. The CMOS chip can address 16Mbytes of memory compared to the 6502's 64k. It has an 8-bit external bus and internal 16-bit bus. The most amazing feature is that it's pin compatible with the 6502. Just remove the 6502 from its socket and replace it with the W65SC816. Then just set the E bit in the status register and it performs just like the 6502. If the bit is off, the device becomes a 16-bit device.

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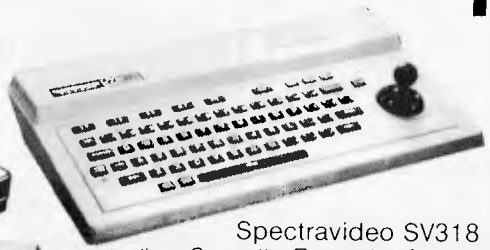

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WORKSLATE

After extensive research among end users who required their micros for spreadsheet tasks, the US company Convergent Technologies came up with the idea of a portable 'huggable not luggable' machine whose main purpose would be to handle spreadsheets. This idea has now become a reality. Robin Webster and Leslie Miner went along to the company's head office to find out how it all came about.

The last 18 months or so has seen a tremendous upsurge in the development of portable computers of the type that can fit in a briefcase or be easily lost under a pile of magazines.

It was once thought remarkable that a small, hand-held computer terminal could be carried around by an individual for use in the daily work routine. Early devices were typically 'cramped' looking and bothersome to use — there was one that required the regular operation of three shift keys just for the letters of the alphabet. Software was virtually non-existent since the early terminals had only a minimum memory allocation, and data was output to a limited two or four-line light-emitting-diode (LED) display that was maybe 10 or 12 characters wide.

Now, companies like Epson, NEC, Tandy, Sharp and Panasonic have all committed valuable time and effort to the notion of portable computing power. Each of these companies has its own idea of what a portable computer should look like and what it should be able to do for the professional user. As such machines are of greatest use in specific applications, they should not be looked upon as complete replacements for desktop personal computers.

Generally, current portables have the following in common: multi-line, liquid-crystal displays, 40 or more characters in width; full keyboards that are fairly reasonable versions of full-size 'qwerty' equipment; and microcassettes used as a data storage medium. In a few cases, internal modems for communications work and integral printers to record the results of data manipulations are included.

Available software remains generally not very impressive, but the latest company to seek a major share in all the action may have adopted a promising approach.

US West Coast-based Convergent Technologies (better known for its high-quality office workstations) has designed its WorkSlate portable computer around a single concept.

Software Arts, the developer of VisiCalc, took the green paper spreadsheet that cluttered every financial worker's desk and essentially turned it into a dynamic piece of software that would run on any number of general purpose computers. Convergent has now taken the spreadsheet software idea and turned it back into something tangible — a portable computer with the sole purpose of handling spreadsheets (although it can do a lot more than this).

Convergent went public in 1982 and decided that it would concentrate on development in very specific areas.

'a portable computer with the sole purpose of handling spreadsheets (although it can do a lot more than this).'

One branch would continue the development of office workstations; another would set up development teams to work on powerful parallel processors — 'mega-frame' machines based around 32-bit chip technology that can run many operating systems concurrently. A third group would work on the development of 'n-generation' products — future products based on Intel chips.

It was still another group, a company within the company, that developed the WorkSlate. It was the brainchild of Convergent's Matt Sanders; he simply walked around a lot of offices and asked people what they used their personal computers for. Invariably, the answer was they used the PC's for doing spreadsheet work.

The problem with all this, as far as Sanders could see, was that in nine out of ten cases a $4000 or $5000 machine was being used primarily for one application. Considering that this was probably the most expensive way to go about it, Sanders began to ponder the ways in which a dedicated, but inexpensive, 'VisiCalc machine' could be made.

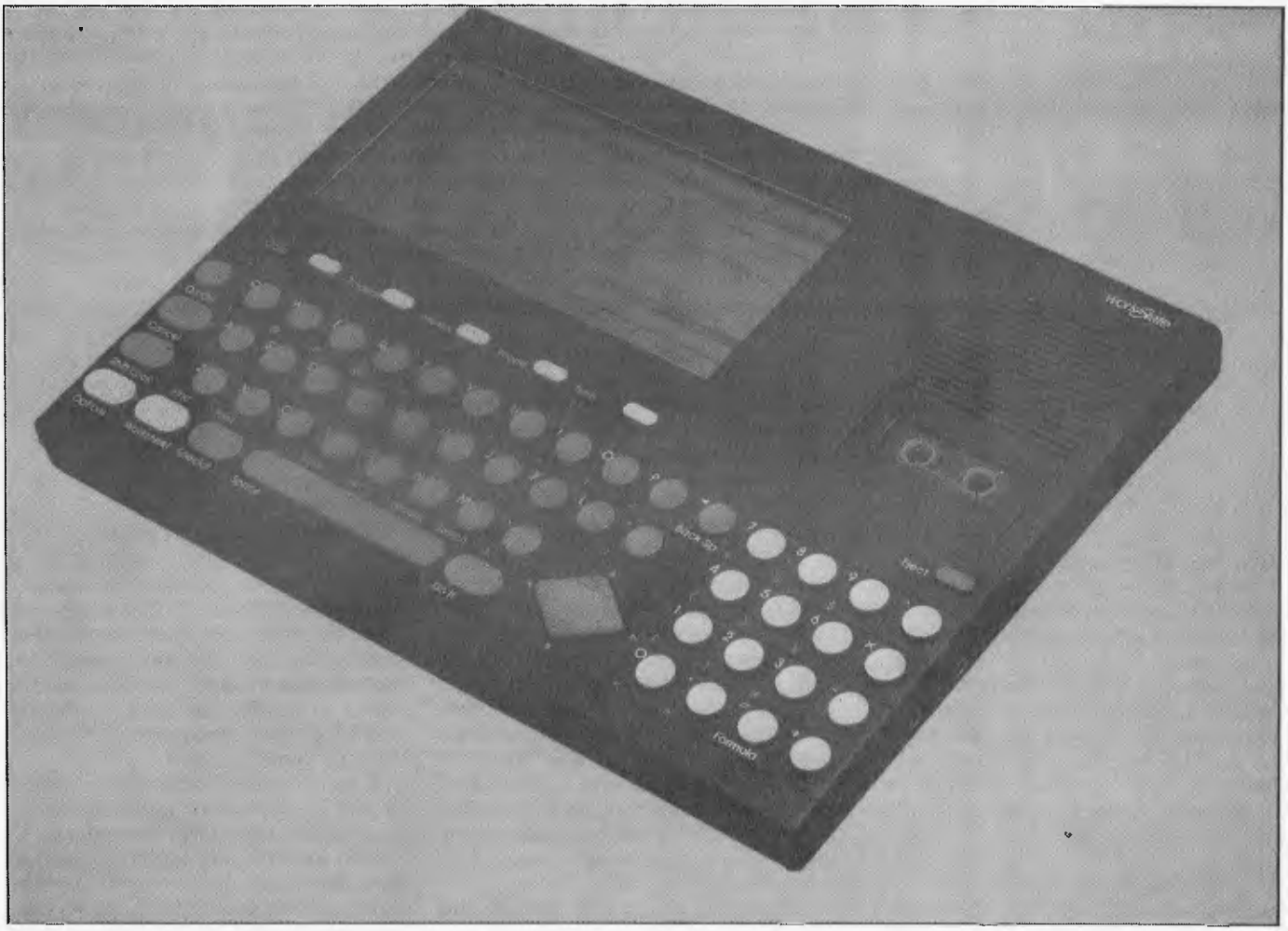
If a large number of the business people in the US — the ten million small business proprietors, one million accountants, six million mid-level managers, and four to five million sales and service personnel — were not doing financial work on personal computers because of their complexity and price, then such a product would be extremely viable.

With a WorkSlate-type product, these people would not have to make 'shot-in-the-dark' decisions about which personal computer to buy, which operating system to run, how much memory to install, and which spreadsheet was the best.

The tempting, but often misleading, vendor promises the claim 'my spreadsheet is better than your spreadsheet' could be more or less ignored, if, besides being easy to use and relatively inexpensive, the new product could incorporate all the best features of current spreadsheet packages.

Having convinced himself, and the necessary Convergent Technologies executives, that a portable spreadsheet computer would find a ready market, Sanders was given a budget with no other specific directives. The project, in development for 14 months or so, was kept a secret from all but a few top people in the corporation. It was given the code name 'Ultra'.

Sanders found a base for the project in an old building in Santa Clara. It was dubbed 'The Vault' because the building had once housed a credit union, and the Ultra team had to handle one unexpected problem: people would leave cash on the



At first glance, the WorkSlate looks like some kind of grand calculator due to its LCD display

receptionist's desk and walk out, thinking they could still make deposits to their credit union accounts.

The WorkSlate development team included people recruited from Motorola, Hewlett-Packard, Texas Instruments and Atari. The team obviously benefited from such diverse influences.

Karen Toland, marketing manager in the WorkSlate division, and one of its key designers, worked at Savin for about 10 years in the field of office automation and word processing. 'We knew from the beginning that the WorkSlate had to be portable; it could not be tied to an AC mains plug, and this required that we use CMOS technology. It also had to be a true portable, something that went into a briefcase, but didn't take up all the space. Most of the so-called portable computers on the market are difficult to transport — I liked to point out that we were making a huggable machine, not a luggable machine.'

Hardware

The WorkSlate is indeed a very compact device measuring a mere 8½ × 11¼ × 1in, and weighing less than 1½ kg. It can easily be mislaid among a pile of office documents, or in a desk drawer.

A wide range of features are packed in. There is a specially designed LCD display which can show 16 lines × 46 characters. The machine also featues a unique twin-head microcassette drive developed by Olympus for Convergent which can record data in digital form along one edge (track) of a standard microcassette and record verbal messages in analogue form along the other. Other features include a built-in 300 baud, auto-dial, auto-answer modem, 64k of ROM-based software and 16k of user RAM.

At first glance, the WorkSlate does look like some kind of grand calculator, because of its LCD display, its textured black plastic shell and small, circular keys. There is an immediate sense of portability about it. This contrasts with the 'hard' aluminium/stainless steel look of many other portables which appear to be designed heavily in keeping with the standard typewriter keyboard.

In fact the design and subtle colours are quite pleasing, and rather more handsome than is apparent in the photographs. The smooth grey sculpted keys are just ergonomic enough.

The display, after familiarisation, is just large enough to be useful. The key labels — white for alphanumeric, green for special functions and yellow for other functions — are just distinctive enough to be helpful.

Display

Since the WorkSlate was given a relatively large display, Convergent has been able to divide it into a number of distinct areas that keep the user informed of events.

Although the screen can show 16 lines by 46 columns at a time, the top line is used by the system as a 'status' line.

The first eight characters of the top line show the filename. You are allowed to use alphabetical, numeric and punctuation characters. If the box contains the word 'empty' then the worksheet has not yet been named (similar to the 'TEMP' default name given to all unnamed files in the Multiplan spreadsheet system).

The next 16 character space is used to show the contents of the active cell — the cell where the cursor is currently located. If the active cell contains the result of a formula, then the formula will be shown, rather than the formula product.

The area containing the number '79%'

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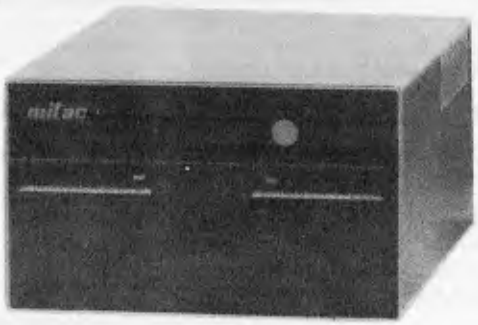

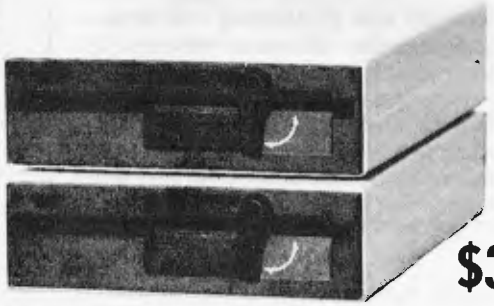

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keeps track of the remaining amount of WorkSlate memory available to you (this is set to 100% at the beginning). It also occasionally displays a small square and cell counter which indicates that it is off searching or calculating and has 'X' number of cells to process.

The empty box next to this is used for showing further pictorial symbols; an example is the small picture of a telephone handset when you use the WorkSlate for communications work and the phone is ringing, on hold, or off the hook.

The next two sections are clearly there to show the current date and time, and these can be set and reset by the user through the various menu options.

Column labels (A, B, C, etc) are displayed white on black and stretch from A to Z to AA to DX, and the current column is marked by a small arrowhead shape set to the right of the pertinent label. Similarly, row labels, which go from 1 to 128, are highlighted and use the same arrowhead location marker.

Two lines at the bottom of the screen can display menus, the contents of which depend on whatever task the user is doing. Since they change frequently, from task to task, they are called Action keys.

LCD displays are often difficult to read in varying light conditions, but Convergent has found a satisfactory way around this. Along the left edge of the WorkSlate, there is a display intensity dial that you can adjust.

Keyboard

There are a total of 60 keys on the WorkSlate. Most allow the user to input more than one character or carry out more than one action when used in conjunction with a 'shift' key. Each key is no more than fingertip size; the relevant symbols are pointed onto the black casing off to the left of each key.

Ordinary alphanumeric input is possible by pressing the circular grey keys alone (the white characters are input). Punctuation and other important symbols and/or actions (marked in green) are invoked by first depressing the green 'Special' key at the bottom left of the keyboard. Keys with yellow markings are often used keys like the space bar, shift and on/off.

By this means, the WorkSlate can be made to generate the full A-Z, 0-9 range, punctuation marks (! @ # , ? " ;), and symbols such as the Boolean '>' (greater than), or '#' (not equal to).

WorkSlate-specific keyboard functions include keys that will **Find**, **Print**, **Save**, **Get**, **Recalc**, **Switch**, and **Do It**.

'Do It' was the idea of Karen Toland who played a very important role in getting potential end users involved in the design process at a very early stage. She also battled with the programmers and engineers because she wanted the WorkSlate to have a 'Do It' key instead of the usual 'Enter', 'Return', 'Execute', or 'New Line' buttons.

'It was a radical idea to the engineers that users be involved in the design process,' said Toland, 'but I don't think they would have it any other way now.'

Standard printer output is 40 characters wide

The oval **Worksheet** key to the left of the **Special** key is used in conjunction with the five oval buttons just below the display — marked **Calc**, **Finance**, **Memo**, **Phone**, and **Time** — to list the range of worksheets that are built into the WorkSlate.

Each of these worksheet keys brings up a particular set of Action keys on the bottom two rows of the display, as mentioned earlier.

Calc is an on-screen calculator feature, and its use with worksheets is explained later.

'Finance' produces a specially set-up financial analysis worksheet that guides the user through such tasks as net present value, and future value analyses.

'Memo' brings up a memo pad type of worksheet which can be used to store brief textual messages or, if you really need to, up to 3000 words or so of text — although it is not a word processing system (it has no word-wraparound, for example). The Action keys relating to Memo are concerned with voice recording (Stop, Play, Record, etc).

'Phone' is a phone-list worksheet which is set up to store a contact's name, telephone number and address, and the 'Action' keys allow the WorkSlate to function as a phone (Dial, Hang Up, Answer, Speaker Phone). What's rather neat is that the phone number listed in the worksheet can be automatically dialled by the WorkSlate if you wish.

'Time' brings up time-related action keys and also displays a personal calendar worksheet. This allows you to enter the details of a future meeting or task and then have the WorkSlate alert you about it nearer to the time by setting off an alarm and displaying a message.

The 'Options' key at the bottom-left corner of the WorkSlate is a very important addition since many more keys, or more complex set of commands, would be needed without it. Like the Worksheet key, it is also linked with the five buttons underneath the display so that at any point while working with a spreadsheet (built-in or otherwise) you can gain access to built-in commands.

Pressing Options once will reprogram the five buttons so they now offer the ability to: CHANGE, or edit, data already on the worksheet; CLEAR data that is no longer required (anything from a cell to the whole worksheet can be CLEARed); COPY the data in one cell or area to anywhere else on the spreadsheet (useful for certain kinds of headings or drawing boxes around data); DELETE data at all levels; and to change the DISPLAY defaults (do you want to have commas in your numbers, or do you want to display the formulas on the worksheet? — for example).

Pressing Options a second and third time lists the commands DRAW, FORMAT, INSERT, MOVE, NAME, and SET UP, SORT, WIDTH, and WINDOW. Suffice it to say that by selecting one of these options further sub-menus with more and more specific key assignments appear.

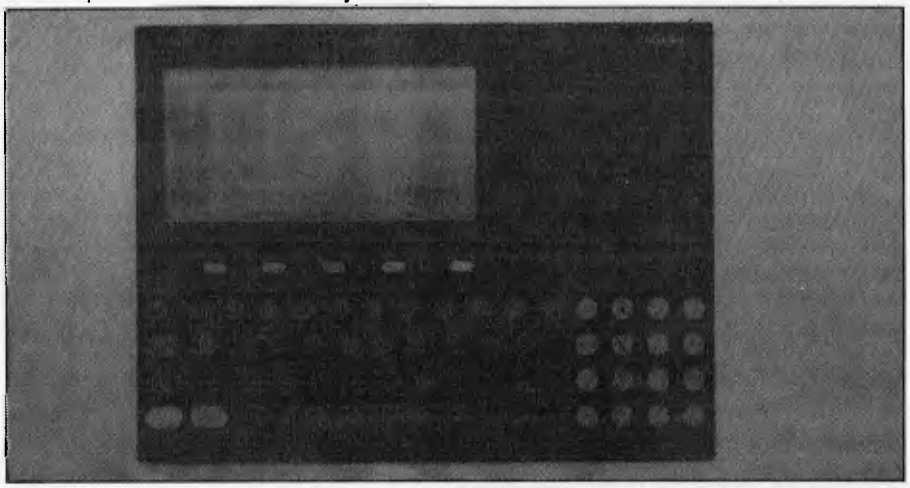
In between the main key section and the 16 key numeric/special symbol pad occupying the right-hand side of the unit, there is a four-way cursor controller which is rather fun to use. It is a combination of a

'The WorkSlate comes with a selection of built-in functions and worksheets which Convergent believes will meet the immediate demands of the user.'

joystick and the traditional arrow keys (press the top of the diamond shape and the cursor goes up, etc). Other machines would do well to use this design.

The On/Off button is located at the top left of the keyboard area, just above the CANCEL key, which cancels any operation in progress or eliminates menu displays.

Initially, it was difficult to use the keys accurately, mainly because they are a cross between the standard typewriter layout and a calculator keypad, and also because the complete WorkSlate is actually smaller



A compact machine with a specially designed LCD, and an ergonomic keyboard.

than most PC keyboards. The characters are placed off to the left, and the Special key has to be used to enter commas, question marks and quotes. But once accustomed to the layout — a matter of minutes rather than hours — data entry became quite easy.

Probably the most difficult thing to come to grips with is the quick-thinking that has to be done when deciding which of the keys marked Options, Worksheet and Special you need for a task, and subsequently which Action key, or menu selection, you need to accomplish your goal.

Microcassette drive

At the top right of the WorkSlate is the microcassette recorder/data storage unit. One microcassette can store up to 10 spreadsheets only (five to each side of the tape), or up to 30 minutes of audio information. A powerful use of the WorkSlate's ability to store data in both analogue and digital form is that the two may be used simultaneously — so creating, among other things, the concept of voice annotated spreadsheets. This kind of annotation will be of great importance to the target users since spreadsheets — even well formatted ones — tend to require further explanation when shown to those not involved in their original development. The voice feature could also probably be used to help to train people to do a particular job with the machine (Convergent itself supplies the narrated Teach Me Now and Teach Me Later microcassette-based learning packages with the WorkSlate).

When a user inserts a cassette, the system puts up the message 'checking for data' to indicate that it is looking at the tape's directory. This directory is located at the beginning of the tape, so the search takes just a few seconds. Once it has completed the search, the WorkSlate returns the user to wherever he left off in an application. Those people used to the rapid data access offered by floppy/hard/RAM disks might find the time it takes to save or load data from the microcassette a bit long, but it is not a big problem.

Loading a 61 row × 4 column spreadsheet from tape takes about 26 seconds. Rewinding a tape after turning it over (the directory is located at the left hub end of the tape) takes about 70 seconds. These times are acceptable although not impressive.

Just above the cassette drive, hidden by a plastic grille, is the speaker. When the WorkSlate needs to inform the user of some event it emits a beep. And, of course, when there is a verbal message, it will play it on demand. Because of its limited dimensions, the WorkSlate has all its I/O ports set into its sides, which are only one-inch deep. On the right side there is a dial that controls the speaker volume and two small jack-plug sockets — one for an earphone and another for a microphone. The microphone is not completely necessary since an internal IC mike is provided. Along the back edge, to the right, there are three telephone jack sockets and a DC power inlet. Two of the phone sockets are used to connect the WorkSlate 'in line' to a standard telephone to enable it to carry out auto-answer or auto-dial procedures. That is, it can act as a limited telephone answering machine (it will answer with a message, but is currently unable to record phone messages) and will automatically send worksheets over the telephone network to other WorkSlate's or host computers.

The remaining telephone jack is used to connect the WorkSlate up to all sorts of peripherals, including Convergent's own MicroPrinter — a companion product that measures 1¾ × 6½ × 8½in and which runs off batteries or an AC adaptor. It uses 4½in wide paper and can print between 40 to 80 characters per line.

For a portable computer to be reliably portable, it must be able to carry its own power source around with it. Convergent has tried to make completely sure that no WorkSlate user will have to see the frustrating sight of a completely 'dead' machine because he forgot to put in a new set of batteries.

You can use the machine off the mains, with the 6 volt AC to DC converter supplied, or you can use four AA size batteries which supply enough power for eight to ten hours. Or you can use the optional rechargeable NiCad battery pack which can be topped up every five hours or so by the 6 volt DC transformer.

If for some reason the power source should fail, there are still two button batteries (digital watch type) which will maintain all worksheets in memory for up to a week. If you get to that point, the WorkSlate displays a message advising that you replace them.

Access to the AA battery and button battery compartments is from underneath the machine. The retaining lids fit snugly, and the batteries are not allowed to rattle around. Also underneath the machine is a small foldaway rest which can be opened up when the WorkSlate is being used on hard surfaces. The flap inclines the machine towards the user, so making its operation and viewing of the display much more comfortable.

If you really get into a jam, or just want to clear the machine's memory, a tiny reset button is situated under the front edge of the WorkSlate. You will need something with a fairly fine point, maybe a ball-point pen, to operate it.

Using the WorkSlate

The WorkSlate comes with a selection of built-in functions and worksheets which Convergent believes will meet the immediate demands of the user. Those users who require more complex worksheets can, of course, create them as required. Let's take a look at some of the built-in features first.

The Calc function. This will be a real boon to those who use conventional spreadsheets and regularly find themselves having to add numbers up on paper (or in an unused cell somewhere off to the right of their work area) whenever a total

figure must be input. Totalling company inventories, which tend to vary widely, might be such an occasion.

The WorkSlate offers a far simpler and nicer method of doing such additions. By pressing Special plus Calc, a small window-like area opens up along the bottom of the screen containing what is obviously a calculator display and function keys. All the standard calculator functions can be carried out, with the WorkSlate using its current worksheet as a data storage, or memory, area (shades of Lotus 1-2-3). The result of any calculation can be added to (M+) or subtracted (M–) from the currently active cell in a worksheet.

Values already entered into the worksheet — without the aid of the Calc function, and even if they are the result of a formula — can also be transferred onto the calculator display by selecting the Recall M option. Store M simply places the current calculator display value on the worksheet — it does not record the figure on the column of sub-totals and past calculations that appears at the top of the calculator display like a roll of paper tape. If the MicroPrinter is attached during calculator mode, a hard copy can be obtained with negative numbers automatically printed in red.

The Finance function/worksheet. If you have ever been faced with creating and recreating various spreadsheets to do loan amortisation, depreciation, and net present value (NPV) calculations, you'll be relieved to find these functions ready-to-go in the WorkSlate. It's worth taking a cursory glance at one of the depreciation procedures to see how the WorkSlate keeps you on track.

First, you press Special and Finance to obtain a menu listing the functions **Deprec, Loan** and **NPV** and the WorkSlate prompts 'Select an action key'. Selecting Deprec lists another menu which offers the choices of **Decline, Straight** and **SumYears** depreciation and the prompt 'Select a method of depreciation'. Pressing Decline (which handles declining balance calculations) leads to a really specific menu — **%Rate, Book, Salvage, Period #** — that will be used, in conjunction with the correct responses to WorkSlate prompts, to finish the task. This kind of hand-holding is great, and reduces sensible, but rather tedious, calculations to an easy routine.

The Memo Worksheet. The memo key allows you to dictate and record messages onto a microcassette. The WorkSlate protects careless users from recording over already stored data by first checking the beginning of each tape for a voice or data tape identifier. If it is a new tape, or a voice tape, the WorkSlate displays the message 'Tape has no data'. If data is encountered, the prompt would be 'Data tape: Record will erase'.

To control the microcassette drive, the five action keys are assigned the values of the piano-like keys found on standard cassette equipment: **Record, Play, Stop, Rewind, Forward**. These operate explicitly, but there are some things you don't have to worry about — for example, you don't have to press the Stop key to switch from fast forward to rewind.

The Phone function/worksheet. After attaching your WorkSlate to a telephone, or even just a telephone socket, it is possible to use the machine for many communications purposes.

It will allow you to answer phone calls using the built-in speaker phone. It will dial numbers listed in your PhoneList worksheet (accessed by pressing Worksheet and Phone) automatically, or allow you to enter other numbers via the numeric keypad. It will automatically make calls to or receive calls from host computers (such as *Dow Jones* and *The Source)* and other WorkSlates, or send worksheets to and receive worksheets from another WorkSlate (see the section on Data communications).

If you are too busy, the Phone function also allows the WorkSlate to act as a one-way answer-phone machine — playing a recorded message to all callers.

'Like the adjustable LCD display and the twin-head cassette drive, the $249 MicroPrinter is a unique technological development.'

The Time Function/Calendar worksheet. Naturally, through the time options you can set the system time and date. Pressing Special and Time gives the menu: **Alarm, Date, Set Time, Timer** and **Reset**.

Selecting Alarm displays the prompt 'Type date, time for alarm, then press Do It'. The present time and date is displayed for you to change and then the WorkSlate prompts 'Type message, then Press Do it'. At the pre-set date and time, the WorkSlate turns itself on, sets off an alarm beep seven times, and then indicates which worksheet contains the message to be read.

When Timer is selected, the WorkSlate displays a clock icon and counter instead of the current date and time. This feature is pretty much like running a stopwatch to mark elapsed time. The Reset option is used to reset the timer.

But you can do much more in the Time function mode. It gives you a two-week calendar period to work with, based on the worksheet principle. By giving the calendar start date, the system updates the following days according to an embedded formula. Messages can be typed in and alarms set for any day within the two weeks.

Setting up worksheets

Setting up a spreadsheet on the WorkSlate

```
      A          B          C
 1  EXAMPLES OF MATH/LOGIC FUNC
 2  ---------------------------
 3                  10.00
 4                  20.00
 5                  30.00
 6                  40.00
 7                  50.00
 8
 9  AVERAGE =       30.00
10  MAX     =       50.00
11  MIN     =       10.00
12  ---------------------
13                  10.10
14                  21.26
15                  22.22
16
17  TOTAL   =       53.58
18  INTEGER =       53.00
19  ROUNDED =       54.00
20  ---------------------------
21  Raise 9 to the sixth power.
22
23       9.00  to power 6
24     equals 531441.00
25            ----------
26
27  ---------------------------
28  Truth checking with IF/AND.
29
30              22000.00
31              11000.00
32
33  IF cell A30 > 20000 AND cell
34  A31 < 15000 display "error"
35  else display "OK".
36            ----------
37              error
38            ----------
39
40  ---------------------------
41  Truth checking with IF VALUE,
42  VALUE1, ELSE VALUE2.
43
44                81.50
45               125.00
46
47
48  IF cell A44 > cell A45 THEN d
49  "re-enter data" ELSE display
50
51            ----------
52              great!
53            ----------
54
55  ---------------------------
56  Date and Time arithmetic usin
57  US format of month/day/year.
58
59  Problem: Find the difference
60           8/14/46 and 9/12/84
61
62                9/12/84
63       minus
64                8/14/46
65              ----------
66       equals     13909 days
67              ----------


   D        E
ONS.
```

Examples of maths/logic functions

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LDOS
Runs almost all Radio Shack Model III software. Includes: extended disk BASIC that is upward compatible with TRS-80 Model III BASIC; advanced operating system features (input/output [I/O] redirection, filters, job control language, password protection; and many valuable utility programs (high speed backup, direct disk maintenance, a number of filters, and even a modem communications program).

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The built-in controller can read and write single and double sided, and single and double density, formats of 3½ inch, 5¼ inch, and 8 inch floppy drives. The MAX-80 can control eight drives (of mixed sizes, sides and densities) at once.

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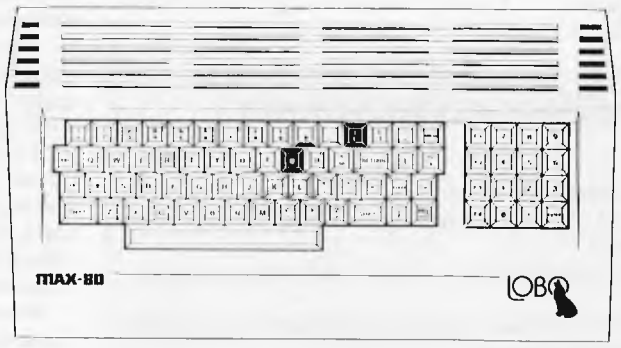

Full Year Limited Warranty
The MAX-80 hardware has a limited one-year parts and labor warranty — which is possible only because of the extreme reliability built in from the start. Call or write for the complete warranty statement.

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follows more or less the same route as might be taken with VisiCalc-type software since the end goal is in essence the same. First, you figure out the application. Then you design a usable format. Then you start entering text and formulas.

With the WorkSlate, formulas are entered into a cell by pressing the button marked **Formula** located on the numeric keypad. This displays the prompt 'Select Action key or Type Formula, then Do It' and, on the next line, 'Cell xxx ='. It then waits for you to type in the formulas.

You can do this the hard way, by manually typing in the row and column labels in the format: A10 = (A1+A2+A3)/(A4+A5+A6) *0.25. Or you can make use of the options: **Average, Maximum, Minimum, Total,** and **Copy Cell**.

Copy Cell is used to copy formulas from cell to cell.

Configuration commands

ACTION KEY	FUNCTION
Terminal	Enables access to configuration options.
Display	Enables access to display control keys Control, EchoPlex, HalfDplx, # Lines.
Control	Displays control character being received from remote computer system.
EchoPlex	Tells WorkSlate to echo back characters received from another WorkSlate or remote computer.
HalfDplx	Tells WorkSlate to transmit characters entered at the keyboard to remote system.
# Lines	Defines the number of lines of the WorkSlate display to be given over to showing incoming and outgoing communications data.
Line End	Allows you to choose the end-of-line character.
^R	Specifies eol as a carriage return.
^F	Specifies eol as a line feed.
^R^F	Specifies eol as combination of the above.
Modem	Accesses the modem configuration keys: parity, Xon/Xoff, parity, and standard.
Parity	Specifies Zero, Ones, Even, Odd or None.
Xon/Xoff	Enables 'handshaking' between remote systems (Workslates and otherwise) and your machine.
Security	Enables you to establish security protection.
Incoming	Sets WorkSlate to receive incoming worksheets.
Outgoing	Sets WorkSlate to transmit worksheets.
Password	Allows you to set up communications password.

Technical specifications

CPU	Hitachi 6303 8-bit microprocessor.
ROM	64k of ROM containing diagnostics, and the Phone List, Finance, and Time/Calendar worksheets.
RAM	16k user memory.
Display	16 line x 46 character liquid-crystal display with intensity control set in the left-hand edge of the case.
Keyboard	60 keys, including numeric keypad. Multiple functions available through almost every key.
Storage	Standard microcassettes obtainable from office supply companies. Each cassette can store up to 30 minutes of voice messages or up to 10 worksheets. Worksheets can be voice annotated. The cassette drive mechanism was specially designed by Olympus for Convergent.
I/O ports	The WorkSlate has two ports along the back edge to connect it inline with a telephone. A third port at the rear is used to connect the MicroPrinter or other peripheral devices. An internal IC microphone is supplied, but there is a socket for a bigger external one. For privacy, an earphone socket is supplied.
Communications	Internal 300 baud auto-dial, auto-answer modem.
Power Source	An AC to DC 6 volts converter is included in the purchase price. Removable power comes in the form of four standard AA batteries, or a rechargeable nickel-cadmium pack. Whenever these options fail, two digital watch-type batteries maintain memory contents for up to a week.

Microprinter

Like the adjustable LCD display and the twin-head cassette drive, the $249 MicroPrinter is a unique technological development. Although the main printing mechanism is manufactured by a micro printer/plotter company called Alps, the internal circuitry and the method of use has been specially reworked by Convergent.

The printing technology is no more complex than the technology in a ball-point pen. Four ball-point-like cartridges (red, green, blue and black), are arranged in a cylindrical holder; they more or less 'write' symbols onto the 4½in wide plain paper which the MicroPrinter uses. Standard output is 40 characters wide, but 80 character 'compressed' output, still quite readable, can also be obtained.

Some personal computer users with Epson or Okidata dot-matrix printers have resorted to buying a special software package that prints spreadsheets out sideways to cope with worksheets that are more wide then they are long (that is, the rows come out at right angles to the paper edges). This is immediately possible with the WorkSlate/MicroPrinter combination; no extra software is required.

In use, the MicroPrinter makes little noise — it just clicks a lot. Power is supplied by a mains adaptor or AA batteries.

Data communications facilities

The WorkSlate can be turned into a communications terminal by means of the SET-UP command. You can, for example, make the machine communicate in half duplex, instead of full-duplex mode. The end-of-line can be set as a line feed instead of a carriage return, and so on.

If you are a regular user of online computer services, then it would probably be worth your while to create an automatic sign-on sequence rather than type in ID, password and service type commands each time.

Sign on sequences are typed directly into a worksheet and take the form of the following example in the WorkSlate user manual:

```
A1 = "XYZSYSTEM" + Dial
     ("792-1234", data) + (GoTo(A2)
A2 = Delay(2) + WaitFor ("ENTER
     ID:") + GoTo(A3)
A3 = Send ("JOE^r") + GoTo(A4)
A4 = WaitFor ("ENTER
     PASSWORD:") + GoTo(A5)
A5 = Send ("793AZY702^r") +
     GoTo(A6)
A6 = WaitFor ("!") + GoTo(A7)
```

WORKSLATE

```
A7 = Send("STOCK QUOTE<r>") +
     GoTo(A8)
A8 = Keep(B1...C1,1,1,20) +
     GoTo(A9)
A9 = HangUp(0)
```

The left-hand column (A1,A2, etc) are worksheet cell labels. Note that the WorkSlate's sign-on language requires a GoTo (next worksheet cell) statement at the end of each statement.

The fictional sign-on sequence would connect a WorkSlate to a system that required information in the form:

System Query	WorkSlate Response
Enter ID:	JOE
Enter Password:	793AZY702
!	STOCK QUOTE

Documentation

Convergent has obviously expended a lot of effort in developing its WorkSlate instruction materials. The operation and reference manual is well written, and only gets a little sticky when complicated tasks are encountered.

There is a full index of the contents, and high-quality photographs and illustrations are used to great effect.

The narrated Teach Me Now tape, which is included in the retail price, puts you quickly through the paces of using the cursor to jump around the full size of the worksheet — 128 rows × 128 columns; using the worksheet as a memo pad, recorder, timer, phone and calendar.

Then, in a more complete fashion, it introduces spreadsheet functions, formula creation and explains the knack of using the calculator in conjunction with a spreadsheet. The WorkSlate is in fact capable of a two window display.

Very brief reference is made to 'GET-ting' worksheets from and 'SAVEing' worksheets to the cassette. This has been made quite simple for the user.

Another tape, called Teach Me Later, will be supplied by Convergent to cover the more advanced WorkSlate operations, but this was not available at the time of review.

Of course in the manual, there are the usual warranty disclaimers. One to watch for is that Convergent says it will not accept charges for mis-dialled calls . . .

Prices

WorkSlate, complete with AC to DC adaptor, Teach-Me instruction tapes, blank cassette, owner/reference manual, soft carrying case, and a toll-free assistance number: $895

MicroPrinter, with roll of paper, a set of four coloured pens, carrying case and owner's manual: $249

Range of optional Taskware tapes, including Personal Tax, Sales Reporter, Loan Analyser, Estate Planning, and Financial Statements: $29.95 to $49.95

Conclusions

Other WorkSlate products are planned for release later this year. Probably the next one to appear will be a portable word processor with a larger screen and a keyboard more suited to writers. But for now there is only the one, designed around the daily work tools used by office managers.

The longer you use the WorkSlate, the more useful it seems to become. It handles many routine chores in an effortless way. Although it is portable, it has sufficient power and flexibility to be more than just briefcase ballast.

It can act as a telephone and telephone answering machine. When you need it, it can even send worksheets over the telephone network to a colleague in unattended mode (not such an unusual idea — we recently had to arrange such a configuration).

It acts as a recorder, a typewriter, and of course, as a very sophisticated calculator.

It will be interesting to see if the extensive market research, which Convergent carried out prior to manufacture of the WorkSlate, was accurate. This research dictated every detail of the product: user group feedback indicated that managers don't want to type, resulting in a keyboard that is more like a calculator than a typewriter.

Well, anyway, it was the star item in this year's American Express Christmas catalogue.

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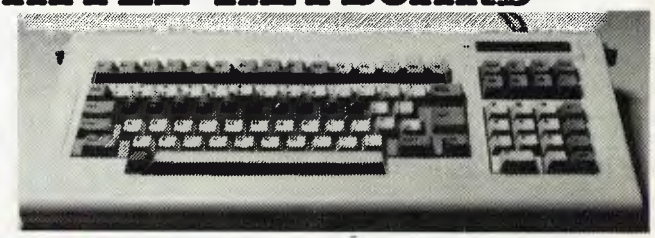

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VISUALL

The concept of on-screen window display is not new and has been adopted by companies such as Apple and Xerox with some degree of commercial success. Robin Webster examines a less conventional software offering from the three-man Trillian Computer Corporation, which is being marketed as a 'visual shell' between the operating system and the user.

The idea of allowing a computer user to display and work with more than one application by means of on-screen 'windows' is not new. The most significant work is traced back to Xerox, which started the whole thing with its early, experimental 'Alto' systems and the Smalltalk language. Xerox has continued to market the idea of a multi-window applications environment with some degree of success in the form of its commercially available 8010 workstation. Apple recently added its less powerful, but equally impressive, Lisa office system to the effort (see *APC* August).

The software developers have been busy, too. By the time you read this, VisiCorp should have ironed out most of the problems it was encountering with the Visi On system for MS-DOS machines and Quarterdeck will have launched DesQ (reviewed last month), a windowing system that integrates off-the-shelf applications packages like dBase II, Multiplan and WordStar.

Despite all this feverish activity by such large companies, a small company called Trillian Computer Corporation (a staff of three, including the president, at the time of this review) is trying to make a niche for itself with a rather unconventional window system called VisuALL.

VisuALL is not a window-based system in the same sense as Visicorp's Visi On or Quarterdeck's DesQ. It is instead a package which sets up a so-called 'visual shell' between the operating system and the user — a kind of neat front-end to the MS-DOS command line interpreter. Instead of dealing with the A> prompt directly, the user has VisuALL to do the following:

"copy example, txt b:*.*"

at the DOS level or;

"Control-K, Control-E, from: **oldname, Enter,** to: **newname, Enter"**

to rename a file when using the WordStar word processor, thus minimising the user's keyboard tasks.

Installing VisuALL

Since VisuALL is not a replacement for the operating system, it must be installed like any other package. However, in contrast to the more complex windowing packages already mentioned, VisuALL can operate without large amounts of memory or a hard disk. The minimum requirements are an IBM Personal Computer, 64k memory, one single or double-sided disk drive, a standard 25 lines by 80 columns monitor and an IBM PC-DOS disk.

If you already have a mouse, a hard disk, an IBM XT or a colour monitor, VisuALL will function that much better.

After booting up the DOS disk, you place the Trillian distribution disk in drive A, a DOS working diskette in drive B and type the command 'INSTALL'. This copies the necessary VisuALL files to the DOS working diskette. If you only have one drive, disk swapping will be necessary.

This installation procedure supersedes the one contained in the VisuALL user manual which asks you to: '1. Have your system work diskette in drive A and the VisuALL diskette in drive B with the DOS A> prompt on the screen . . . 2. After the DOS prompt type: b: INSTALL2 and press Enter . . .'

I encountered two problems with the updated installation method. The first was that my system disk had too many files on it already and consequently it took a while to delete enough files so that everything went smoothly. The second problem was that VisuALL did not start up properly when I reset my computer after the installation.

Instead of auto-loading itself after the reset, VisuALL promptly went into some kind of loop and never finished loading.

The only way around this the first time was to depress the Ctrl-Alt-Del keys again, load the DOS disk, and 'manually' load VisuALL by typing the 'Visuall visuall.pro' command after the A> prompt appeared. This worked fine.

I was using a Compaq instead of an honest-to-goodness IBM PC and thought this may have contributed to the problem. According to Trillian president Peter Redford, though, VisuALL *did* work on the Compaq and he suggested I go through the installation routine again. I did and, this time, everything went smoothly.

While these problems were easily overcome, the potential user should be aware that the VisuALL system is in fact made up of two fairly hefty files, VISUALL.COM and VISUALL.PRO.

VISUALL.COM is the program that handles everything to do with drawing the pseudo-windows on the display, changing windows and making the necessary translations from window commands to MS-DOS reality. It is 45906 bytes in size. The second file, VISUALL.PRO (25732 bytes) is the window layout library for the VisuALL system. When you initially install VisuALL, a set of window definitions is supplied by Trillian. These include DOS COMMANDS, EDITOR COMMANDS (for the Edlin program), BASIC COMMANDS, WORDSTAR, LOTUS 1-2-3, and PERSONAL EDITOR COMMANDS.

Initialising 'visual shells'

Once VisuALL is loaded, the familiar A> prompt appears indicating that nothing extraordinary has happened so far.

VisuALL only becomes apparent when you press the mouse or function keys in a

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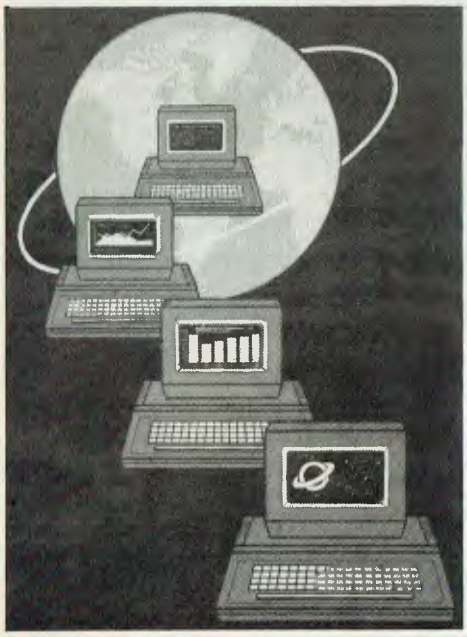

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predefined way. On a three-button mouse you would press the 'select' and/or 'execute' buttons. On an IBM or IBM work-alike keyboard you would probably press function key 'F1' (depending on how each user customises, or initialises, VisuALL).

The specifications you must supply to initialise shells are as follows:

```
System
  Baud          =1200
  Comm          =2
  Mouse         =Speedster
Button
  Select        =Command
  Mark          =Ins
  Execute       =Enter
  User          ="This button has
                  not been defined"
Cursor
  right         =rightarrow
  left          =leftarrow
  up            =uparrow
  down          =downarrow
Keyboard
  Select        =s-F1   ;shift F1
  Mark          =s-F2
  Execute       =s-F3
  User          =s-F4
```

The first two lines of the System section are used to tell VisuALL that the attached mouse can handle data at a rate of up to 1200 baud, and that it will be attached to the second installed serial communications board. 'Speedster' is the name which Trillian has assigned to a specific manufacturer's mouse. Three types are supported at present: the Mouse Systems optical mouse (Sportster), the Logitech mechanical mouse (Speedster), and the USI opto-mechanical mouse (Indian).

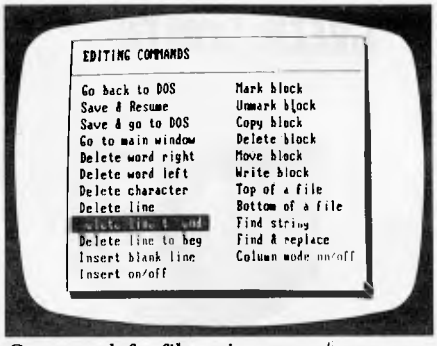
All initialisation statements for the Sportster and Indian models must contain a value for the communications port entry since they must be connected to a serial board of some sort. But the Logitech Speedster mouse does not require an entry since it connects to the same port as the keyboard. A 'T-connector' is used to attach both at the same time, although this mouse cannot currently be used with machines like the Compaq which do not feature snap-in cable connectors.

The Button section simply designates the effect of each mouse button: pressing the 'Select' button has the value 'Command', the 'Execute' button has the value 'Enter', and so on. Similarly, the Cursor and Keyboard sections link key depressions with a specific action. In the Keyboard section, though, you will notice that each function key name is preceded by a lower-case 's'. This signifies that the shift key must be pushed along with the function key so that there are no conflicts with application program assignments of function keys.

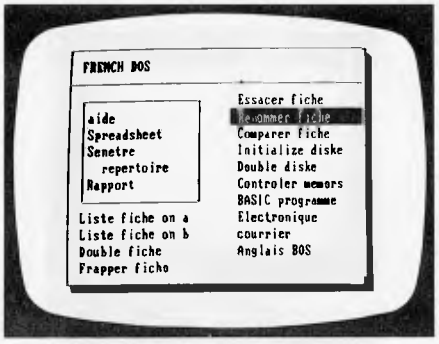
If you want to redesign a current window, or create one from scratch, this is possible. In fact, you can create families or 'hierarchies' of windows (with a maximum of 48 separate windows within the bounds of one application) — each window getting more specific as you go deeper and deeper.

For example, you might want to develop one window for each class of operation in an application: with a word processor you would design windows for editing, file handling, text formatting and printing.

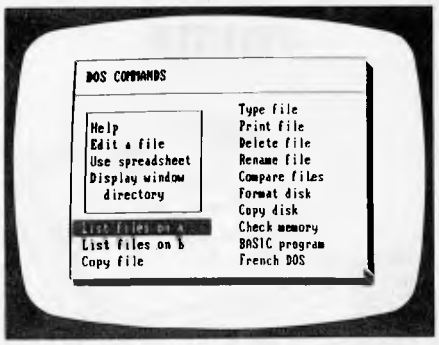
The design process is fairly simple, since all you are really doing is writing instructions in a kind of meta-language which can be understood by the VISUALL.COM program. Screenshot 1 shows how Trillian has used the meta-language structure for a WordStar environment.



Commands for file maintenance/program loading



DOS foreign language visual shells



The window directory shows possible activities

In use

All operations were carried out by pressing the four function keys F1 to F4.

At the DOS level you display the DOS COMMANDS window by pressing the F1 (Select) key. The DOS COMMANDS window always appears in exactly the same location but, unlike the windows in Visi On and DesQ, VisuALL windows cannot be moved, re-sized, or set aside on the desk-top.

The distinction is that VisuALL windows are not application program windows — they are essentially pop-up (drop-down?) command menus that can be displayed at any time. These windows can be displayed without the user having to escape from the task at hand.

The DOS COMMANDS window contains all the commands you might need to carry out file maintenance or program loading (see screenshot 1). Positioning the cursor over a menu option causes the option to be backlit; it can then be activated by again pressing Shift-F1.

Some commands — such as Help, Edit a file, Use Spreadsheet, and Display window directory — will cause other sub-windows to appear listing a range of additional options. As you can put your own choice of text into a window, you can develop foreign language visual shells as evidenced by the 'French DOS' entry (screenshot 2).

If a filename, or a couple of filenames, are required by DOS, VisuALL displays a prompt (filename:, from:, to:) at the bottom left edge of the open window.

To get an overall idea of what windows are available, you must go to the window directory. This directory contains main headings for the range of possible activities, including Spreadsheet, Choose Editor (most people would prefer the Personal Editor to Edlin), Editing Commands, Basic Commands and Printer Commands (screenshot 3).

Earlier I mentioned that problems could be encountered when switching from one window type to another. An example is when you select the option to run Lotus 1-2-3. VisuALL presently has no way of knowing whether or not Lotus 1-2-3 is 'out there' somewhere on disk or in memory. It assumes you know what you are doing and have started a valid procedure.

Unfortunately, if Lotus 1-2-3 is not accessible, the operating system will respond to the 'load 1-2-3' command in its normal unfriendly manner and just wait for the next event.

Although it appears that nothing untoward has happened (error messages are displayed in some cases), VisuALL has in fact dumped the DOS COMMANDS window shell and made the Lotus 1-2-3 shell the current one.

The manual goes on to warn the user to be careful not to '. . . switch shells via the Window Directory . . .', since this will cause the VisuALL system to have a skewed idea of what is going on. Yet another mistake is trying to invoke a VisuALL window as information is being scrolled on the display. This can mess

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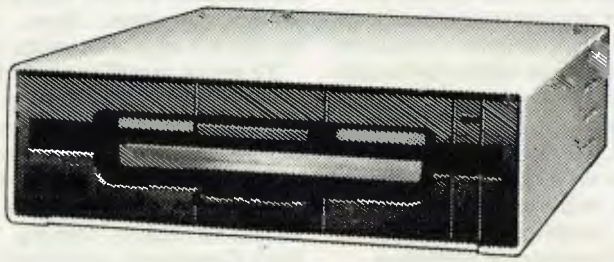

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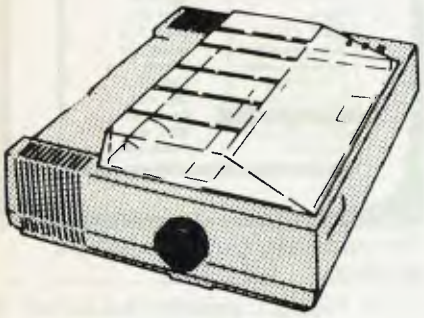

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things up in its own right so that the whole VisuALL system has to be rebooted.

If VisuALL is being marketed as the friendly front-end system for personal computers running MS-DOS, my concern is that these acknowledged loopholes reduce its effectiveness.

You cannot tell PC users they will never have to worry about complex commands ever again, and then go on to expect them to keep track of the exact sequence in which VisuALL windows can and cannot be invoked. Maybe it's a small point, something which 98% of VisuALL customers will breeze through, but it is surely also a small matter to incorporate the right kind of code to keep such concerns out of immediate view — especially for $295.

Conclusions

The manual was generally very good at explaining how you use VisuALL and where you might encounter certain limits. I had no problem in understanding what the VisuALL profiles were doing, and how I could alter them at will.

Apart from the one minor installation problem, VisuALL performed pretty much as stated, and certainly smoothed out some of the rough spots in PC-DOS's user interface by hiding much complexity behind the windows.

I would view VisuALL as a good product for someone who really doesn't understand the kind of dialogue that is necessary between a user and the PC-DOS operating system before anything gets done. Because of this, it is likely that VisuALL will be of the greatest benefit for the first six months after purchase. By then, the user should have figured out what is going on and be ready to handle routine tasks without VisuALL's help. The danger is that a user may remain dependent on VisuALL to such a degree that, without it on another system, the A> prompt and a flashing cursor is all the user is left to work with.

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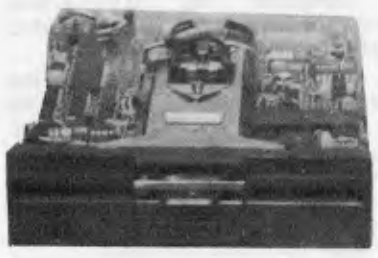

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ABSOLUTE DIFFERENCES OF PRIME NUMBERS... AN HYPOTHESIS OF GILBREATH.

Mike Mudge presents more mathematical mind-benders

A Prime Number is defined to be a positive integer greater than 1 that is divisible only by itself and 1. Thus the sequence of primes (known since the time of Euclid c 400BC to be infinite) begins
P = (2,3,5,7,11,13,17,19,23,29,31,37,41, 43,47, . . .).

The first row of the table of Absolute Differences of Prime Numbers is obtained from P by taking the absolute values of the differences between successive terms: thus
$|\Delta_1 P|$ = (1,2,2,4,2,4,2,4,6,2,6,4,2, 4,6, . . .)

This elementary process is repeated to obtain consecutive rows of absolute differences:
$|\Delta_2 P|$ = (1,0,2,2,2,2,2,2,4,4,2,2,2, 2,0, . . .)
$|\Delta_3 P|$ = (1,2,0,0,0,0,0,2,0,2,0,0,0, 2,4, . . .)

For any positive integer n we define a_n to be the smallest positive integer such that the $(a_n + 1)$ − th. term of $|\Delta_n P|$ is the first such term to be greater than 2; thus from the above $a_1 = 3$, $a_2 = 8$, and $a_3 = 14$.

In 1958, NL Gilbreath conjectured that the first term in each row, $|\Delta_n P|$, is unity. If we could prove that $a_n > 2$ for all n then the validity of Gilbreath's conjecture would be established.

*W Sierpinski, *A Selection of Problems in the Theory of Numbers*, Pergamon Press, 1964, page 35. Empirical evidence suggests that a_n is indeed a rapidly increasing function of n, but to the best of my knowledge the required result has not been proved.

Problem

This month's problem is in two distinct parts:
(i) To generate the first N-terms in the sequence P of Prime Numbers for a given N.
(i[1]) Alternatively, justify the direct input of P from existing tables or a 'library-tape'.
(ii) To generate the first M values $a_1, a_2, a_3, \ldots a_m$ for a given M, verifying in the process that $a_4 = 14$, $a_5 = 25$, $a_{10} = 59$, $a_{15} = 174$.

Conjecture the type of function best describing a_n as a function of n: this work may be aided by the use of a graphical output device if available. A valuable reference could be provided by RB Kilgrove & KE Ralston, *On a conjecture concerning primes*, MTAC vol 13, pp 121-122. 1959.

Note. Please include, in addition to the usual program listings, hardware descriptions, run times and output, a count and breakdown by type *viz* multiplication, addition, etc, of the number of arithmetical and logical operations needed to establish $a_{64} = 5940$. This may be precise or an intelligent estimate; its purpose is to compare and contrast the widely differing approaches which are possible to this problem.

Submissions will be judged for accuracy, originality and efficiency (not necessarily in that order), and a suitable prize will be awarded to the 'best' entry received.

Entries to arrive by 15 February, 1984, to: Mr M R Mudge, C/- *APC*, P.O. Box 298, Clayton, Vic 3168.

Note. Submissions will only be returned if suitable stamped addressed envelopes are included.

Review of n-tuples

The response to this project was most disappointing, whether due to the weather, the title, or some property of the problem is not apparent.

It would be most informative to receive readers' suggestions as to why this problem was found to be particularly unattractive and perhaps to indicate desirable characteristics of number theoretic problems suitable for investigation using a microcomputer.

(i) The smallest common sum of four associated triples is indeed 118, arising from (14,50,54)a(15,40,63)a(18,30,70)a (21,25,72).

(ii) The smallest common product of four associated triples is indeed 25200, arising from (6,56,75)a(7,40,90)a(9,28,100)a(12, 20,105).

Minimum sum n-tuples.

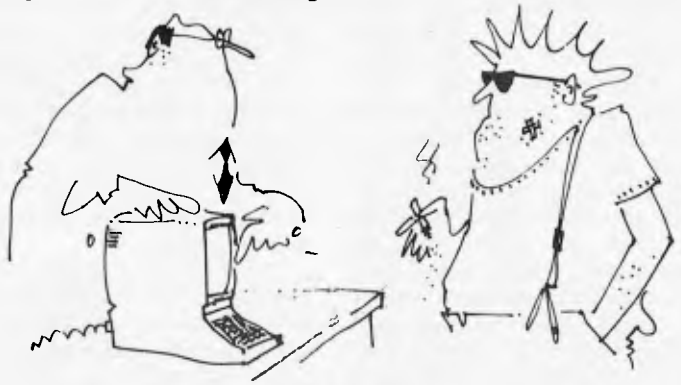
		Sum	Product
Triples . . .	N		
	4	118	37800
	5	185	83160
	6	400	846720
	7	511	1965600
There exists no 8-tuple with sum less than 835.			
4-tuples . . .	4	24	720
	5	42	7200
	6	52	10800
	7	51	7200
	8	60	20160
	9	71	30240
	10	80	75600
	11	105	100800
	12	105	201600
There exists no 13-tuple with sum less than 112.			
5-tuples . . .	4	20	360
	5	25	720
	6	30	2160
	7	34	2880
	8	39	4320
	9	47	10080
	10	45	8640
	11	53	14400
	12	54	30240
	13	52	20160
	14	61	20160

There exists no 15-tuple with sum less than 61.

Many of the above results are due to our recent prizewinner, Mr G Grant.

PS Why is each product listed in the table divisible by 360? Answers on a postcard to GS GG or MM !!

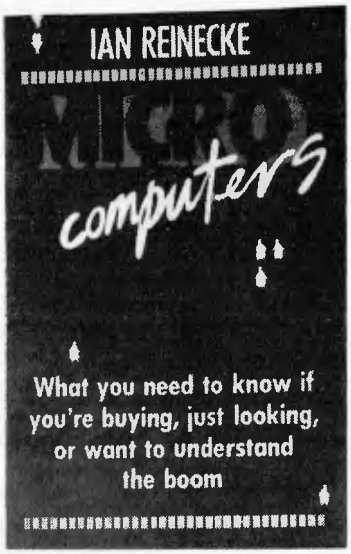
END



'Let me put it this way — it can remember what was in the charts last year but it can't remember why!'

BIBLIOFILE

Once again Steve Withers has been weaving his way through the maze of computer books available.



Microcomputers

The blurb on the cover of this book reads "What you need to know if you're buying, just looking, or want to understand the boom". This could be misleading, as "Microcomputers" is certainly not a buyers' guide – it is more like an exercise in debunking the mythology created by advertisers. If you believe that a $200 home computer will help your child get a job or into University, you should read this book.

It is a pity that Ian Reinecke did not find a co-author with some knowledge of computing. Right through the book he erroneously writes about storage media like disk and tape as if they are interchangeable with memory: "For [$200 or $300], they receive a keyboard and some of the computer memory necessary to run programs . . . On top of the keyboard, additional memory is needed to store the information you intend to feed into the computer. This may be a separate attachment which contains plastic discs [sic] or it may be an ordinary cassette recorder" (p10). Some of the other errors include the description of a light pen as one "which transmits a beam of light" (p53) rather than a device that detects light from a video screen; and that "a printer of sufficient quality for letters will cost a minimum of $2,000" (p70) when they are available for less than $1,000. These aren't the only mistakes, believe me.

Having ruled out the "buyers" and the "lookers", what about understanding the boom? Reinecke seems to be saying that the micro industry is a giant con trick, that it will not provide any benefits for "ordinary people". Firstly, there are the effects on employment. Will the growing application of microcomputers make people's jobs less rewarding? Other writers have suggested that increased automation will remove the need for people to carry out trivial, repetitive tasks, and that the resulting improvement in productivity will mean our society can afford to turn to truly humanitarian activities as a source of employment. Secondly, he asserts that the cost of computing is so high that it prohibits any useful domestic application. I disagree: for the cost of medium-price VCR you could buy a system which permits fairly simple word-processing and spreadsheeting. Why should these be useful at home? Well, the quality of my writing improved when I started using a word-processor (I wish I'd had one when I was at school), and budgeting with paper and pencil is so time consuming that few people bother - a spreadsheet makes this worthwhile job so much easier.

One of the most worrying observations in the book is one that is not really related to microcomputers as such. Several years ago, a group of surveillance and computer experts came to the conclusion that the best way of keeping tabs on the population of a country and any visitors would be the introduction of an electronic funds transfer system.

Despite my (possibly harsh) comments, I believe that "Microcomputers" is worth reading, providing you don't put your faith in the technical content. The descriptions of the way various companies work are interesting, and the book serves to remind us that very little should be taken at face value. Definitely thought-provoking.

Microcomputers
Author: Ian Reineche
Publisher: Penguin Books, Ringwood, Vic.
Price: $6.95

All about 1-2-3

At present, Lotus 1-2-3 seems to be *the* piece of software for managers, so it seems natural that publishers will turn their attention to it. This particular book is an example of a recent phenomenon in publishing, a volume that is little more than publicity material for a product. Although the authors are apparently unconnected with Lotus Development Corporation, they are surprisingly uncritical. Is 1-2-3 really that good?

Quite honestly, "All About 1-2-3" told me little that I hadn't already learned from Mike Liardet's "Which Spreadsheet" report (APC December

1983), and I expect that the majority of APC readers would feel the same. It seems that this book is intended for managers and professional people who aren't already clued up about personal computers, but who have heard about some of the useful things they can do.

Accordingly, the book starts with some background information, intended to answer the most likely questions asked by such people. It explains the meaning of terms like "desktop computer", "spreadsheet", and "data base management", why professionals should consider using word processing or graphics, and the significance of "integrated" software.

The real value of "All About 1-2-3" is that it contains a number of short case studies that show how the program can be used. Various exercises are outlined, including a comparison of the performance of three corporate divisions, keeping farm records, and making investment decisions.

Finally, this book contains one of the best pieces of advice for micro users that I've seen in a long while: "A good rule of thumb is to save your work every quarter hour, every time you think of it, and every time you don't have anything else to do".

All about 1-2-3

Authors: Robert Schware and Alice Trembour
Publishers: Dilithium Press, Beaverton OR, USA
Price: $16.95

Instant Arcade Games

Another example of an author and publisher extending the mileage of a good idea – the two editions of this book (covering the ZX Spectrum and the BBC Micro) are very, very similar. The basic idea is that there are two types of arcade games: "shoot-'em-up" and "chase" – and that a variety of different games may be created by plugging different players and backgrounds into a skeleton program. The author likens this approach to Lego bricks; a fair analogy, except that it is possible for a programmer to make his/her own bricks!

Some of the possibilities are quite odd. How about an alien skull chasing a frog down a ski slope? Or would you prefer a spider in pursuit of a sand yacht in front of a city skyline? Of course, there are more conventional scenes, like two cowboys shooting it out in the desert. How bizarre do you like your games?

Sound effects, scoring and all the other elements of an enjoyable arcade game are given appropriate attention in both editions of the book.

Despite the titles, there are large sections devoted to Adventure games. The same approach is adopted, i.e. a driver program augmented by subroutines giving the game its particular character. Provision is made for different scenarios ("your mission, should you decide to accept it..."), and of course the objects involved and actions open to the player can be varied according to taste.

One fringe benefit of these books is that they encourage good programming techniques, not least the idea of *designing* a program rather than simply throwing it together. In fact, I'm almost tempted to suggest that they are worth buying as first books on Basic programming.

Instant Arcade Games for the BBC Micro and Instant Arcade Games for the Sinclair ZX Spectrum

Author: Jean Frost
Publisher: Pan Books, Sydney

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WHICH SPREADSHEET?

SORD'S FALC

Mike Liardet takes the lid off a sophisticated spreadsheet system, with an extensive range of facilities, for the Sord M5 home computer.

Sord is a Japanese company that has previously confined itself to manufacturing business computers. Although virtually a household name in Japan, it has not yet made a great impact in Australia. Recently it launched its first home computer, the M5, which has a superficial resemblance to the Sinclair ZX Spectrum, and is obviously intended to grab a fair slice of this booming area of the computer market.

Background

One package available for the M5 is rather cryptically named FALC. FALC is a sophisticated spreadsheet system with a surprisingly large breadth of facilities. Sord obviously hopes that everyone will be FALCing about in the near future — the manual's preface claims that it is for 'the working mother, mother at home, working father, father at home, or their children'.

FALC's sophisticated design can be directly attributed to another cryptically named Sord product called PIPS ('Pan Information Processing System'). PIPS is a spreadsheet cum database system, first launched way back in 1980, for the Sord M20/23 and M200 range of business machines. Sord must have missed a great opportunity with PIPS, since at the time of its first release the world had yet to wake up to VisiCalc, and if things had been handled differently we might have had PIPS in the record books and a range of PIPS-clones instead.

Anyway, when Sord decided to try its hand at the home computer market and include a spreadsheet option for the machine, it looked to PIPS for the design ideas. Accordingly FALC was born.

My review system for FALC simply comprised a standard M5 computer with the FALC package itself. The M5 (reviewed in *APC*, September 83) occupies an area slightly smaller than this magazine, with a qwerty keyboard (rubber keys) and special slot for ROM cartridges. Included with the M5 are all the necessary leads for connecting to a TV and cassette recorder, plus a substantial power supply pack, Basic ROM cartridge and manuals.

It is fairly easy to fit all this lot together, with the manual giving clear instructions on what to do. The M5 has video outlets for both monitors and domestic TVs, a nice feature, but it's easy to get them mixed up. There is no damage done if you do, you just spend a long time fruitlessly tuning your TV with no image appearing.

There are lots of dire warnings in the manual and on the M5 itself that you must switch off before you insert a ROM cartridge. The M5's power-on light is not very bright, so I only felt safe doing this with the mains-lead unplugged altogether. It's a pity that Sord did not arrange a combined on/off switch with cartridge-lock, then the user would not have this worry, and Sord would not have to deal with all those blown ROM cartridges.

The ROM cartridges are about the size of a cassette-tape box, with a well-protected edge connector at one side. You just press firmly into the socket on top of the M5. If you insert the Basic ROM cartridge, supplied as part of the M5 system, and switch on, then you are free to start Basic programming immediately. There are in fact other optional cartridges available, including more sophisticated Basics. The FALC software is a further cartridge option ($80). [Since this article was written, Mitsui have been promoting the M5 by including the Basic-G and

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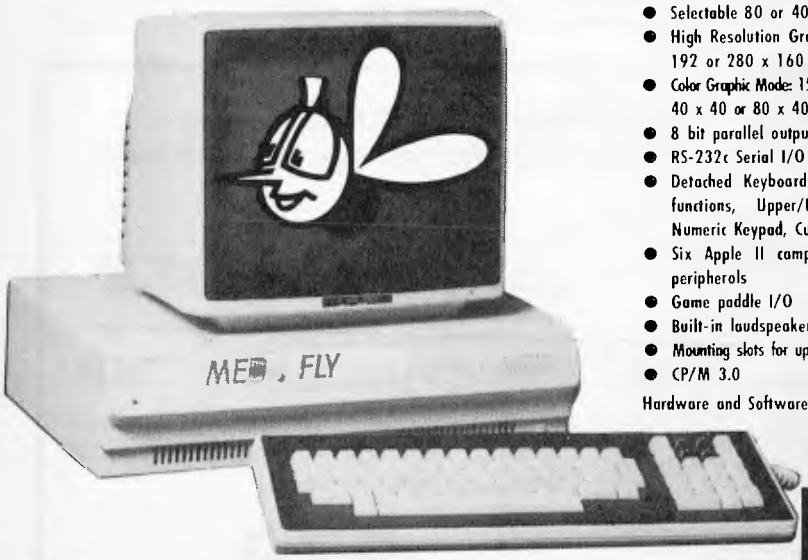

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FALC cartridges in the price of the computer — Ed.] Press the FALC cartridge in, switch on, and you instantly enter the world of FALC.

FALC is a refreshingly different spreadsheet system. It has quite a number of features in common with VisiCalc but has evolved from a completely different branch of the world's software tree. Its immediate ancestor, PIPS, was developed independently, and presumably without knowledge of VisiCalc. Accordingly, while still being a spreadsheet system, FALC works in a different way from most of the other spreadsheet packages.

Initially these differences are not too apparent. Following switch-on, there is a very brief pause for initialisation, and then a fairly standard type of spreadsheet display appears on screen. Like most inexpensive home computers the M5 does not provide an 80 character by 24 line display, the standard for more expensive machines. Instead we are treated to 24 lines, but a width of only 32 characters. Initially each cell of the spreadsheet is allocated seven characters display space, thus allowing for four columns of cells to be displayed. The very bottom of the screen is reserved as a 'scratch-display', so actually only 20 of the 24 lines are available for the spreadsheet itself.

Of course, at first all the cells are empty, so most of the screen is just blank space. The top row and left hand side of the screen contain the column and row identifiers and at the bottom is the command-line prompt. Both rows and columns are identified by numbers.

Like the Spectrum, which also has a rubber keyboard, the M5 keys are all marked with several symbols, and this can be a little confusing. On the right of the keyboard are four keys which, among other things, are marked with arrows pointing left, right, up and down. These are laid out in the obvious way, like four points of the compass. But it can't be that obvious or more manufacturers would actually manage to do it this way. Anyway, these keys, if pushed in conjunction with the CTRL key can be used to explore the spreadsheet. Unfortunately you need two hands for the keystrokes, since the CTRL and arrow keys are about as far apart as it is possible to be on this keyboard. But before doing this it is necessary to use the WRITE command. WRITE is one of nine commands available, each selected by pushing its initial letter.

WRITE mode

When in WRITE mode, FALC comes closest to being an orthodox spreadsheet system. WRITE changes the screen colour and a cursor (actually two little arrow symbols at each end of a cell) is displayed. This cursor can be moved from cell to cell using the arrow keys, with attempts to move off-screen causing a rapid redraw so that the destination cell can be displayed at the expense of a row or column lost at the other side. Unfortunately on my black and white TV the arrow characters, denoting the cursor, were very indistinct and I had to peer quite hard to see them. My guess is that no one in the 'land of the rising sun' has to put up with a monochrome set so Sord was not too concerned with this.

As with most spreadsheet systems, it is possible to enter text or numbers at the current cursor position, simply by typing whatever is required. FALC does not, however, accept formulae in this mode, and neither does it differentiate between text and numbers, so the numbers are left just as typed, and not formatted in any way. The amount of information in each cell is strictly limited to the cell width, but different widths for each column of cells can be specified when using the system initialisation command.

A single keystroke terminates WRITE mode and FALC returns to the command menu. You can use the WRITE command in conjunction with a cell's coordinates, and then the first cursor cell jumped to is the one indicated by the coordinates. This resembles the GOTO command, available on most spreadsheets, and enables you to quickly flick between distant parts of the spreadsheet.

Initialisation

Unlike some spreadsheet systems, you must specify information about the dimensions of the spreadsheet before you enter any data. For convenience, FALC does an automatic initialisation at switch-on, giving you eight 7-character columns of cells by 60 rows.

To perform an initialisation the NEW command must be used. FALC needs to know the number of columns and the width of each individual column. It can then allocate as many rows as possible — and the wider the spreadsheet the fewer the rows that it can make available.

Since a cell can only contain as many characters as are allocated to it at initialisation, this exercise may require careful planning. It is rather like designing a record structure for a database system. In fact with highly useful sort and search commands, FALC can be used for very small database-type operations. It shares this distinction with only a few spreadsheet packages like Multiplan and 1-2-3. Unlike them it is severely limited by the M5's low memory capacity — but its hardware is a twentieth of the price!

Implicit in the initialisation process is the ability to allow for some column expansion space, so that there is sufficient room to add new columns of cells later.

Initialisation also permits an area at the top of the spreadsheet to be set aside for headings. The only significance of this is that this area is ignored by calculations, and sorts, etc.

Not all of the initialisation process is irreversible. It is possible to come back later and alter the information on the title area, and also vary the column widths, but the latter does not necessarily work the way you would like: if you enlarge one column at the expense of its neighbour then it simply 'steals' the characters which were in the column next door.

Calculations

When in command-mode, you can per-

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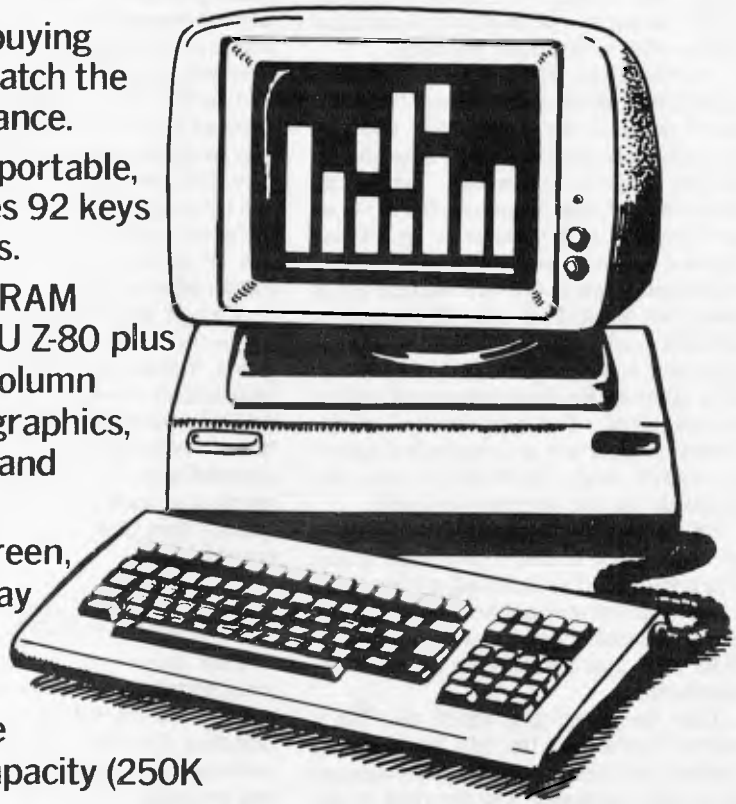

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form calculations on the numbers in the spreadsheet, by entering formulae directly. For example

C2 + C6 = C8

would add the numbers in column 2 to those in column 6, and store the result in column 8. Notice that, unlike most programming languages which are less logical in this respect, the calculation is on the left and the destination of the '=' assignment (C8) is on the right. If column 8 does not happen to be on screen at the time this formula is entered, then the answers can be seen by moving to it with the WRITE command.

It is possible to mix constants in with the formulae, so

C2 – 1 = C5

stores column 2, decremented by 1, in column 5. Other tricks of the trade include the use of '/'

R3 + R13 = / R14

The '/' causes all rows from 3 to 13 to be summed and entered in row 14. Without it there, just rows 3 and 13 would be summed. We can also specify the display format of the answer:

C2 / 7 = C9.0.3

would divide by 7 each number in column 2 and store the result in column 9. The '3' in '.0.3' specifies that the answer is to be displayed with two digits after the decimal place (and the decimal point itself consumes one character position: 1+2 = 3). The '0' determines how the number should be 'rounded', if the real answer needs more decimal places than are provided for, and the last digit is five. For example, to two decimal places 12.345 can be rounded down to 12.34 or rounded up to 12.35. Moreover, a number like 12.349 could be 'truncated' to 12.34. FALC allows you to specify which of the three options you want.

FALC also provides 'block operators' like average, maximum, and minimum. For example,

AVE R5,10 = R11

takes the average of the six numbers in column 1 (rows 5 to 10 inclusive) and stores the result in column 1, row 11; then repeats the same operation for all the remaining columns. For completeness, FALC also provides similar block operators for the four main arithmetic operations, but these can also be dealt with by the '/' facility already mentioned. Thus,

ADD C2,6 = C8

is equivalent to

C2 + C6 = / C8

So far we have seen that FALC has the facilities of a sort of all-powerful calculator. Instead of a single register display a whole array of numbers can be dealt with, and whole rows and columns can be manipulated at will. However, to be really useful, FALC must store the calculation commands as well. This is the basic facility needed for 'what-if' analysis. It becomes tedious recalculating a matrix, following a minor change, if a long sequence of calculations has to be re-entered every time. Sord has obviously recognised this fact, and has done something about it, but not as much as I would like to see, and this is my major criticism of an otherwise very good home computer package.

Essentially it is possible to access an alternative screen where 'programmed functions' can be permanently set up, and subsequently selectively re-executed with a couple of keystrokes. These functions, by the way, need not be confined just to calculations on the spreadsheet, but can also include almost any sequence of commands: cassette reading, searches, etc. Actually when they are invoked they flash up momentarily in the area where you normally see your own typing — just as if you were typing them yourself, only at Superman speed!

The major limitation to this facility is that only one screenful of text can be set up in this way, that is, about 600 characters maximum. This is probably not a great disadvantage for command sequences, but would be fairly easy to exceed the limit with a complicated calculation sequence for a model.

Memory and expansion

In fact memory is very tight on the basic M5, so it is not possible to build up large spreadsheet applications anyway. The situation could be improved by purchasing the 32k RAM expansion pack, which should be available shortly.

However, when the extra RAM does arrive, FALC will not be making the best possible use of it. As the system stands, there is a basic area of just over 4k reserved for the spreadsheet data and programmed functions. This can be instantly transferred, using the PUT command, into one of two buffer areas numbered 1 or 2. The existing spreadsheet can then be freely modified and the original can be restored at any time using the GET command. Now with an extra 32k of RAM, the number of buffer areas will be increased to 9, but the spreadsheet itself will remain at the same size.

Doubtless Sord has organised things this way because it anticipates that the home user is likely to have lots of small applications, rather than one big one. Certainly, this arrangement will be particularly convenient if this is the case, since it circumvents much of the cassette reading and writing that would otherwise be necessary. All applications can be read in from cassette, in one go at the start of a FALC session, and only need be written out once at the end. (Reading and writing to cassette is achieved by PUTting and GETting with names — filenames, rather than numbers — the buffer identifiers.) In the middle of a session, applications can instantly be changed by PUTting and GETting to buffers.

Since it does not appear to be possible for different buffers to communicate results with one another, memory expansion will just facilitate more different applications to be run, but be of no help to anyone wanting to do larger problems. It is a pity that the user cannot control the number of buffers and size of spreadsheet, then he could have the best of both worlds!

SORT and SEARCH

So far we have covered four of the nine commands available: WRITE, NEW, PUT and GET. Two other commands are SORT and SEARCH.

SORT always sorts rows of the spreadsheet. It can sort using any specified column, or multiple columns, into alphabetical or numerical ascending or descending order. For example, if the spreadsheet contains a list of names, telephone numbers and area codes, by specifying a single sort on the area code column, then on the name column, the list would be rearranged, sorted first into areas, then in alphabetical order for names within an area.

SEARCH provides quite a powerful search facility. Like SORT it must be given a column to work on, then searches down it for the 'target' of the pattern specified. The pattern can include joker characters, identical as it happens to those used by the CP/M operating system for ambiguous filenames. Thus the search pattern "*A?C*E" would match only with a cell whose last character was 'E' and containing the sequence "A"+any character+"C" elsewhere. This would, for example, match "ABCDE", "QQQAXCQQQE" but not "ABBCDE".

Other commands

There is a LIST command provided to give printouts of the spreadsheet. I could not test this as I did not have a printer connected. The M5 provides a Centronics interface through a 16-pin flat-cable connector.

The MOVE command allows a rectangular area to be specified as the 'source' of the move, and a possibly different shaped rectangular area for the 'destination'. Single columns or rows are just a limiting case and can be moved with equal facility. The source of a move is not affected, but of course the destination is completely overwritten.

The final command provided by FALC is GRAPH — to plot graphs on the screen. Sord rather underplays this command, which is quite a rarity even on disk-based spreadsheet systems. Anyway the M5 has a character graphics facility, which can be used to make boxes, and so on. The GRAPH command uses these characters, with its colour display facility to build up an attractive bar graph display. The graph is plotted horizontally, not vertically, with each bar corresponding to a row of the spreadsheet. As there are up to 20 rows on display at any one moment, 20 bars can be accommodated. Several columns can be graphed simultaneously, with a bar broken into different colours, to represent the 'contribution' from each column. It is also possible to print this graph, but Sord does not record what printer will do this.

Conclusions

The FALC Package has a feeling of quality about it. As a software package for a home computer it is very good. Perhaps the $80 price tag will deter some potential users, more accustomed to $15-$20 for a games cassette, but it comes supplied as a ROM cartridge with software instantly available at switch-on, and no cassette loading displays. It is also very nicely packaged and clearly documented, taking 100 pages to explain its extensive breadth of facilities. These facilities include sorting, searching and graphics — a rarity even with disk-based software.

Clearly Sord has put its experience at the more expensive end of the micro market to good use and come up with something that is a cut above the usual for the home computer market.

Spreadsheet evaluation

This month I am introducing a new feature to the 'Which Spreadsheet?' series: a 'star' rating for various fundamental aspects of the packages. Actually I shall not be using stars, which could only be positive, but '!'s and '?'s instead. This follows the chess notation where '!' denotes a good move, and '?' a bad one. Each month I will evaluate the spreadsheet under review, in four different categories and anything from three '!'s to two '?'s will be awarded:

!!! = Excellent
!! = Good
! = Passable
? = Poor
?? = Bad

To avoid introducing a long checklist of facilities, I will rate the systems on fairly abstract (and therefore subjective) considerations, which manage to cover just about everything between them:

1. Ease of learning. If the manual has good tutorial material, aimed at a newcomer who knows nothing about computers, and the software is tolerant of a beginner's mistakes and designed so that the user can quickly build up a model of what is happening 'under the bonnet', then it will be deemed 'easy to learn'.

2. Ease of use. This is not the same thing as above. In particular, it is quite difficult to score well on both counts, since easy to use software should work in a fast and concise way, which is generally at odds with being easy to learn. Here the reference documentation is more in question. It should be well indexed, and easy to access information on even the most obscure corners of the system.

3. Reliability and error handling. Obviously a system which crashes regularly or corrupts files and loses data must score badly in this department. Rare programming oversights in distant outposts of the system will not be taken so seriously — after all there is not a software package anywhere in the world that does not somewhere have a bug of this nature. To score well the system must be 'positively robust', and by good design prevent the user from making mistakes, and with well thought out explanations when s/he does.

4. Facilities. This category will give some limited measure of the facilities available in the system, but if you want to know more, then read the article! Obviously, I will be more generous in my marking when looking at home computer software. You cannot reasonably compare facilities between packages differing in price by a factor of ten or more.

FALC scorecard

Easy to learn:	**! (passable)**
Easy to use:	**!! (good)**
Reliability/error handling:	**! (passable)**
Facilities:	**!!! (excellent)**

Checklist

Documentation:	100-page manual. Nicely presented and occasionally illustrated. Well indexed. A few minor misprints.
Facilities:	Only simple arithmetic: + - * / , average and mean, but extensive facilities elsewhere; graphing, sorting and searching.
Spreadsheet size:	3600 characters available. Can be configured with up to 100 columns, or up to 100 rows. Defaults to eight columns X 60, each column seven characters wide. Room for two spreadsheets with standard M5, nine with addition of 32k expansion RAM.
Max column width:	30 characters.
Benchmarks:	(see *APC* April 83) 1. (a) (b) (c) could not be tested. (d) 6 rows per second. (e) 4 columns per second. 2. Max rows of text accommodated: 34. 3. Max rows of numbers: 30.
Price:	$80 (Currently included with Sord M5 at $395).
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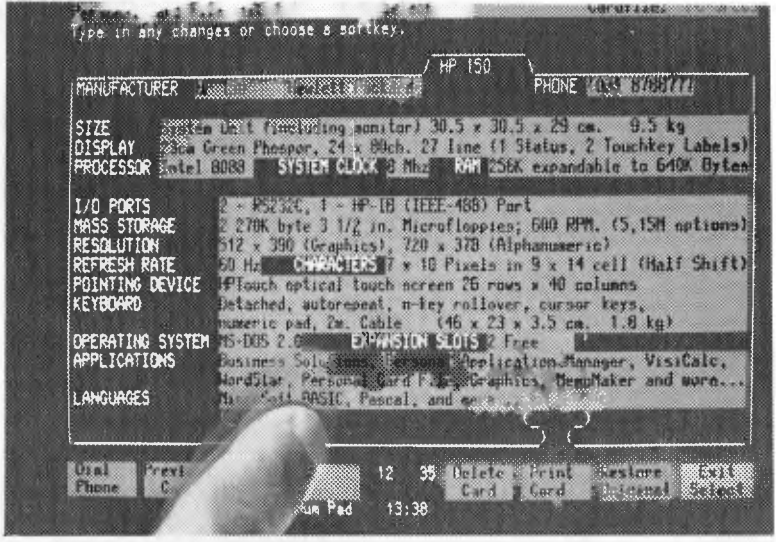

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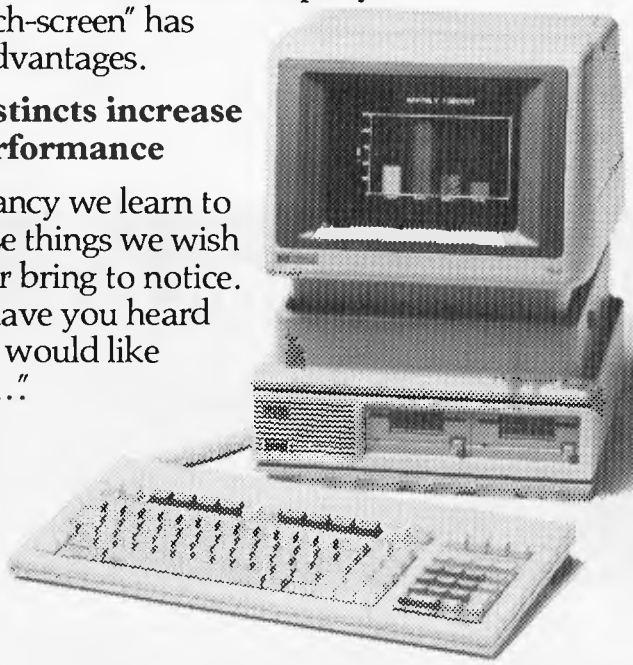

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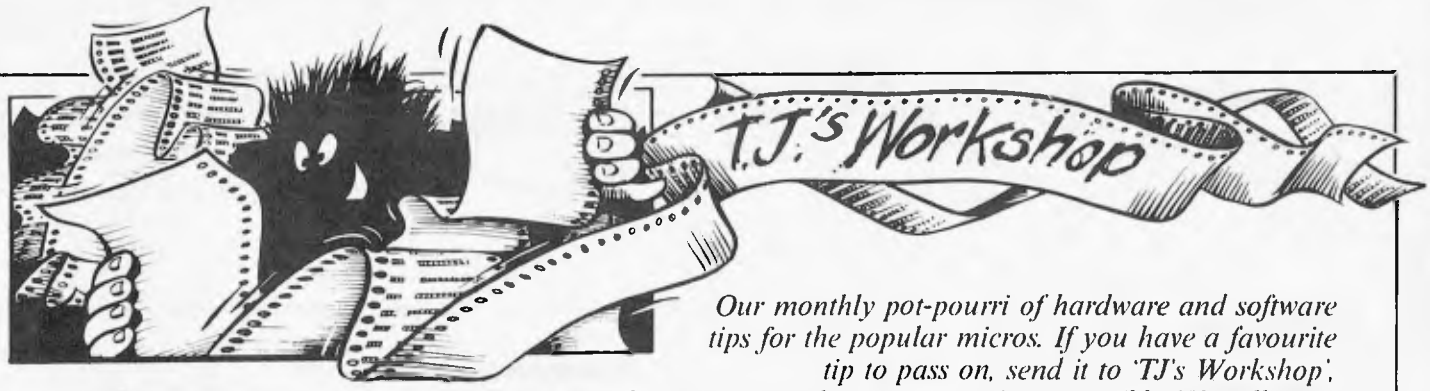


Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', 77 Glenhuntly Road, Elwood, Vic 3184. Please keep your contributions as concise as possible. We will pay $10—$30 for any tips we publish. APC can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

VIC accelerator

I have here a little sub-routine for a VIC-20 which will change the operating speed of a program. I recommend it be placed at the start of the program — just after the instructions is usually the best place.

Here is a breakdown of the routine.

Lines 10-60 set up a menu.

Line 70 sets up the input and gives it the name K; line 80 checks to see that K is legal.

Line 90 prints an error message if it's not and line 100 POKEs the value K into the correct location to control the speed.

```
10 CLR: PRINT "00-32
VERY SLOW"
20 PRINT "33-65 SLOW"
30 PRINT "66-128
AVERAGE"
40 PRINT "129-190 FAST"
50 PRINT "191-255 VERY
FAST"
60 PRINT:PRINT:PRINT
70 INPUT "HOW FAST";K
80IFK}0 AND K{256 THEN
100
90 PRINT "CHOOSE
AGAIN":
GOTO 70
100 POKE 37879, K
```

You could also use this POKE code during a program, to make it speed up gradually, such as in a game, that is,

```
1000 IF SCORE 1* 1000
THEN K=K + 100
```

But nothing is perfect. When you change the operating speed of your VIC, the real time clock is no longer real time, so you must decide between time-keeper and speed.

Kiaran Smyth

Simulated 'REPEAT UNTIL' function

Most Basic interpreters, including Microsoft Level II, do not support a REPEAT UNTIL command. One method of simulating this function is to execute a FOR NEXT loop with a very high 'TO' value and to jump out of the loop before it has been completed. For example, the following program would find the lowest integer with a square greater than 150:

```
10 FOR X=1 TO 100
20 IF X  2< 150 THEN
NEXT X
30 REM Rest of program
```

Unfortunately this method unbalances the stack and would disrupt outer loops in a nested system. This serious disadvantage may be overcome as follows.

The Basic listing shown loads a machine code routine into the top of memory. This routine is called by the TRS-80 CLOSE command (not used in non-disk systems). When called, it cancels an incompleted FOR NEXT loop, and then continues execution of the Basic program. The syntax is the same as that of NEXT, i.e. CLOSE cancels current FOR NEXT loop; CLOSE N cancels the FOR NEXT loop which uses variable N.

```
10 CLS
20 REM Adjust memory size
30 N=PEEK
  (16561) + PEEK (16562)
  *256-58
40 POKE
  16561,N-INT(N/256)*256
50 POKE 16562,INT(N/256)
60 REM Enter vector for
  'CLOSE' command
70 N=N + 1
80 POKE
  16774,N-INT(N/256)*256
90 POKE 16775,INT(N/256)
100 REM Enter machine code
110 FOR A=N TO N+57
120 READ N
130POKE A,N
140 NEXT A
150PRINT "DONE"
160 CLEAR 110
170 END
200 DATA17,0,0,196,13,38,
  34,223,64,205,54,25,194,
  157,25,43,43,43,235,237
  115,38,65,42
210 DATA38,65,235,229,
  175,237,82,68,77,209,33,
  16,0,25,235,43,237,184,
  237,115,38,65,42,38
220 DATA65,17,17,0,25
  249,42,223,64,201
```

The following additional program verifies that the new command has been implemented correctly:

```
300 ONERROR GOTO 380
310 For A=1 To10
320 CLOSE B
330 CLOSE
340 NEXT
350 IF A=3 THEN PRINT
  "ALL OK":END
360 PRINT "CHECK
ENTERED CODE WITH
LISTING"
370 END
380 A=A + 1
390 RESUME NEXT
```

A W Sheppard

Freezing your Commodore 64

These days more games include a freeze facility to totally suspend a game for a short while, enabling you to answer the phone, make a cup of tea, etc. This version for the Commodore 64 is very simple to use.

After running the program given, POKE 777,192 will turn the freeze routine on if the F1 key is pressed and off if the F3 key is pressed. The freeze routine can be switched off with POKE 777,167.

```
10 REM FREEZE—SET UP
  THE M/C
20 FOR T=49380 TO 49397
30 READ A: POKE T,A
40 NEXT T
50 DATA 165, 197, 201, 4,
  240, 3, 76, 228, 167, 165,
  197,201,5,208,250,76,228,
  176
60 REM DEMO
70 POKE 777,192: REM
  FREEZE ROUTINE ON
80 PRINT B:B=B+1:GOTO
  80
```

David Gristwood

Spectrum screenery

Here is a short machine code subroutine to convert the conventional screen POKE into the Spectrum's more exotic version. The m/c can be relocated to anywhere in memory and is used in the following manner:
Let C=N + USR (TV)
where N is the conventional screen location 0-6143 (0-top left corner). TV contains the starting address of the m/c routine.
What m/c does:
When called as recommended the code removes the last no (i.e. N) from the calculator stack (after first checking it is there), turns it into an integer and swaps the three most and least significant bits shown as B and C on the diagram. The plus sign must be used to separate the variable and the USR command as the value of BC on returning to Basic is zero.
Now for the song and dance:
This routine opens up a new aspect to the Spectrum's excellent graphic capabilities. Ex PET high res users can now convert those PEEK and POKE graphics routines for the Spectrum. Also the full 192 by 256 resolution can now be used directly from a simple m/c call from Basic. Two programs are shown here to demonstrate the new command.
1 "Screen invert"
2 "X, Y Plotter"
These are listed separately. The conversion routine can also be used as a subroutine in a m/c scroll up, down, left and right (the list is endless).

B Elbourn

Disassembled listing of Screenery

Hex		Z80 Mnemonics	Decimal
2A 65 5C		ld hl,(STKEND)	42,101,92
ED 5B 63 5C		ld de,(STKBOT)	237,91,99,92
A7		and a	167
ED 52		sbc hl,de	237,82
7D		ld a,l	125
FE 05		cp 5	254,5
30 01		jr nc,OK	48,1
CF		rst 8	207
CD 99 1E	OK	call UNSTACKBC	205,153,30
60		ld h,b	96
69		ld l,c	105
3E 07		ld a,7	62,7
A4		and h	164
07		rlca	7
07		rlca	7
07		rlca	7
07		rlca	7
07		rlca	7
57		ld d,a	87
CB 84		res 0,h	203,132
CB 8C		res 1,h	203,140
CB 94		res 2,h	203,148
3E E0		ld a,224	62,224
A5		and 1	165
0F		rrca	15
0F		rrca	15
0F		rrca	15
0F		rrca	15
0F		rrca	15
CB AD		res 5,1	203,173
CB B5		res 6,1	203,181
CB BD		res 7,1	203,189
B4		or h	180
67		ld h,a	103
7A		ld a,d	122
B5		or l	181
67		ld l,a	111
11 00 40		ld de,16384	17,0,64
19		add hl,de	25
44		ld b,h	68
4D		ld c,l	77
CD 2B 2D		call STACKBC	205,43,45
01 00 00		ld bc,0	1,0,0
C9		ret	201

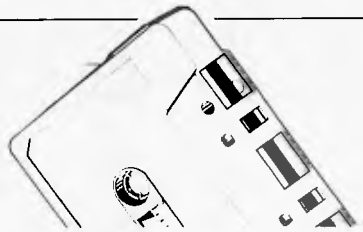
Operation:

HL— 010 00 000 000 00000
A B C D

Explanation,

A The group of eight character lines **B** Pixel row in character **C** Character row **D** Represents the character column number.

The above routine swaps block B and C to produce the correction.



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Demonstration program

```
 10 REM PROG 1 SCREEN INVERT . . . TV CONTAINS START ADDRESS
 20 PRINT "THIS PROGRAM INVERTS SELECTED PARTS OF THE SCREEN"
 30 FOR H = 1 TO 19: PRINT "THIS IS A TEXT SAMPLE": NEXT
 40 REM
 50 INPUT "CHARACTER LINE FOR INVERSION (0-23)";L
 60 INPUT "COLUMN (0-31) FROM "; S; " TO "; F
 70 PRINT#1;"XXXXXXX"
 80 FOR I = L*256 TO L*256+256
 90 LET C = I+USR(TV): REM CONVERSION MADE HERE
100 FOR J = C+S TO C+F
110 POKE J,255-PEEK(J)
120 NEXT J: NEXT I
130 GOTO 50: REM ----------
200 REM PROG 2 THIS PROGRAM DRAWS A SINE WAVE IN THE BOTTOM TWO
    LINES
210 FOR X = 0 TO 255 STEP 5
230 LET Y = 8+SIN(X/15)*8
240 GOSUB 9000: REM PLOT ROUTINE
250 NEXT X
260 PRINT AT 11,5;"Tomorrow the world !!!"
270 PRINT AT 13,2;"Press any key to end program"
280 PAUSE 0: STOP: REM ----------
9000 REM X,Y PLOTTER (256*192) SUBROUTINE (TV CONTAINS START
     ADDRESS)
9010 REM X HORIZONTAL COORDINATE (0-255)
9020 REM Y VERTICAL COORDINATE (0-191)
9030 LET C = (INT(X/8)+INT(191-Y)*32)+USR(TV)
9040 LET J = PEEK C+2 ↑ (7-(X-INT(X/8)*8))
9050 POKE C, J*(j<=255)+PEEK C*(J>255): REM PSEUDO 'OR' OPERATION
9060 RETURN
```

Machine code loader

```
10 INPUT "START ADDRESS";S
20 FOR I = S TO S+67
30 PRINT I,
40 INPUT "BYTE ?";B
50 POKE I,B: PRINT B
60 NEXT I
70 PRINT "FINISHED"
80 SAVE "TV CONV" CODE S,68
90 VERIFY "" CODE
```

Commodore 64 'PRINT AT' simulation

One facility which the Commodore 64 lacks is the PRINT AT command. There are several ways of simulating this command on the Commodore 64, however.

Perhaps the simplest method is as follows:

```
10 REM SIMULATION OF
   PRINT AT L,C,Z$
20 REM LINE L, COLUMN
   C: 1<=L<=25,
   1<=C<=40
30 POKE 214,L:POKE 211,
   C-1:PRINT CHR$(145);Z$
40 REM OR POKE
   214,L:PRINT CHR$(145);
   TAB(C-1);Z$
50 REM FOR PET
   CHANGE 214 to 216
   AND 211 TO 198
```

Note that cursor up, CHR$(145), is required (try removing it) and that TAB should only be used if the previous PRINT did not terminate in a semicolon (again, try it).

It is worth reminding PET, VIC and 64 users of a bug in Commodore Basic. Typing a line number in the range 350720 to 353279 should result in a "?SYNTAX ERROR", but in practice various responses are possible, ranging from an effect similar to pressing RUN/STOP RESTORE on the 64 (or jump to the monitor in the PET), to an irrevocable crash.

Finally, two tips relating to the use of cassettes on the VIC and Commodore 64.

An idea of the number of dropouts which occurred on reading a tape can be gleaned from PEEK(158): a value of 4 or less is usually not significant. The file name of the last cassette read or write operation can be inspected with the aid of FOR T=833 TO 849:PRINT CHR$(PEEK(T));:NEXT

Nick Higham

Epson HX 20 dating call

The Epson HX-20 presents an annoying MM/DD/YY format response to the DATE$ call. A partial solution is achieved by entering the following machine code routine (either by POKEs or through the monitor), after executing MEMSET 8H0A49;

Hex Address	Value
0A40	96
0A41	47
0A42	D6
0A43	48
0A44	97
0A45	48
0A46	D7
0A47	47
0A48	39

A call of EXEC 8H0A40 will then result in all subsequent calls to DATE$ returning a DD/MM/YY response. Why only a partial solution? Wait until the witching hour.

Nic Clift

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Keeping fine time

Most Commodore 64 users will be well aware of the TI$ function which allows access to the inbuilt clock for use in programs. However you are limited to hours, minutes and seconds. It is often the case that a timing system is required that will operate in tenths of a second. Well, it is possible to go one better than that and program in 100ths of a second.

The secret lies in the TI function which reads the interval clock in 'jiffies', or 1/60th second. This value is set to zero on power up and continually increments itself, except when the tape input/output routine is called. Try PRINT TI and RETURN followed almost immediately by another PRINT TI and RETURN. You will have two numbers giving the jiffy count at the moment of pressing RETURN.

To use in programs, refer to the following subroutine:

```
1000 PRINT "(CLS)"
1020 T1=TI:REM**SET T1
     AT START OF LOOP
1030 GET A$:REM**
     INITIATE ACTION TO
     BE TIMED
1040 T2=T1:REM**SET T2
     TO FINISHING OR
     UPDATED TIME
1050 T=INT ( ( (T2-T1)/60)
     *100+.5)/100:REM**
     CALCULATE TIME
     INTERVAL AND
     ROUND TO 2 DECIMAL
     PLACES
1060 PRINT"(HOME)"T:
     PRINT"(CU (7CR)SECS"
1070 IF A$="" "GOTO 1030:
     REM**RETURN FOR
NEXT ACTION
```

Atari screen memory located

I have always wondered where the screen memory is located in my Atari, as many other routines are able to use direct PEEKs and POKEs.

To find the screen location (whatever the memory) use:

```
SCREEN=PEEK(88)+PEEK
  (89)*256
POKE SCREEN,ASC("A")-
32
```

If the character is less than 32, just add 64. To POKE anywhere on the screen use:

```
POKE SCREEN+X+(Y*40,
ASC ("A") -32
```

Alan Ramsey

Eye-saving remedy for Basic bodges

Most of us have, at least once, been driven to distraction by the appearance of the much-dreaded "ILLEGAL QUANTITY" error-message, after many hours of typing in reams of DATA numbers. The trouble is that the computer only hints that the error occurs in a READ line, which means poring over the data lines in the somewhat forlorn hope that we spot the mistake.

I have found the following routine a great eye-saver, and I can usually find the error(s) much more quickly. It simply consists of setting up a FOR NEXT loop.

1 On the line immediately preceding the READ statement, type FOR (X) = i (make sure here you use a number larger than the original "FOR NEXT".

2 On the line immediately following the original READ line, type: PRINT (X); (and then follow the original READ variables either singly, or, if there are very many, two or three at a time).

3 On the following line type: NEXT (X):END

Don't forget END

On running, this will list all the variables and their corresponding DATA numbers, making the job of weeding out the bugs much easier. The three lines that you may have had to erase in order to add the extra ones will probably take less time than you would have taken to find the bugs by yourself.

J Holmes

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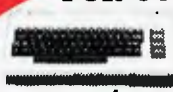

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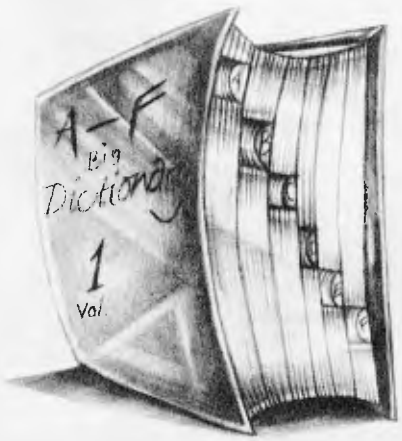
SOFTWARE

Writing with Viza

Trevor Jones is impressed with a new word processor package containing its own dictionary.



The Commodore 64, much vaunted for both home and office uses, is most likely to straddle the two in its capacity as a word processor. Not surprisingly, then that among the rash of serious software written for it are several word processing packages.

Among these is the Vizawrite/ Vizaspell word processing system being sold by The Microcomputer House for a combined price of $169 (the programs can be purchased separately for $129 and $69 respectively).

Features

Both parts are on disk: text files can be stored either on cassette or on disk and the package supports a comprehensive range of printers — from Commodore's own to Centronics models. It handles the 64's 40-character screen in two ways. You can alter the width of the document temporarily to fit the width of the screen or scroll the display sideways as text is entered.

Vizaspell supports a 30,000 word dictionary, to which you can add.

A facility allows page heading and footing texts of any length. Parts of the text can be marked as 'mail merge', so similar documents can be sent to any number of people. It is also possible to merge all or part of a document into another, whether written using Vizawrite, or various other WP packages, such as Wordpro.

A number of utilities supplied with Vizaspell make it possible to copy disks etc. and Vizawrite lets you issue disk commands and display the disk directory.

Presentation

The documentation is excellent: Two manuals, one for each program, each contains a section for the newcomer, while experienced users get a no-nonsense guide. There's a text file with 'help' information, which can be printed out for reference.

In use

The beauty of Vizawrite is that it formats text as you type, using 'format' lines.

In these special lines, which appear in the text you specify print margins, tab positions and so on. There can be any number of them so you can vary features throughout the text. The screen display will show you how your printed output will appear. And, if you subsequently alter, for example, your left print margin, the whole document (up to the next format line) is instantly altered to reflect the change.

Special graphics show such things as tab positions, both within the format lines and in the text. These are entered using the 'CTRL' key, so that, for example, the command to centre text is entered as 'CTRL-c'. If you forget the code, you can move the cursor over the graphics character and the required letter (in this example 'c') is displayed.

Operations to alter text layout are implemented similarly, this time using the 'Commodore' key. The action of these commands is really smooth. To move a block of text from one position to another, you first move the cursor to the start of the block and then press the 'Commodore' key followed by 'm'. The system then prompts you to indicate what is to be moved, to where. At the end of the operation the text is moved quickly and both portions of text are reorganised.

Many commands are carried out in this way. As well as the more usual ones, such as find and delete, there are others, such as displaying the disk directory, saving the document to disk and so on.

It is this method which is used to call up Vizaspell. This is called in from disk and to count the words in the document, which are checked against the system dictionary. You can then scan through your text and look at words not in the dictionary, which are highlighted. Corrections can be made and new words added to the dictionary. This is a very powerful feature, which is implemented extremely smoothly.

A wide range of options is available once the document is ready for printing. The text is displayed on the screen during printing. Parts, or all of it can be printed, and you can string documents together during printing.

Verdict

This program was a pleasure to use. It ran smoothly, did the job professionally and gave no problems. With that, and the extra touches that add to its flexibility, I can give it a very high recommendation, particularly for ease of use.

BRAINSTORM

Brainstorm is a revolutionary new software product which turns creative thought into logical and practical propositions. Jerry Sanders, enthusiastic to discover how best to utilise and exploit his own ideas, takes a lesson in structured thinking.

'The most effective aid to creative thought since the pencil and paper.' So says Caxton Software about its new product, Brainstorm.

One thing that boasts more for a product than any amount of advertising is whether the company who markets it uses it. Caxton's Director David Tebbutt — who first had the idea for Brainstorm — has been using it for three years, and since Caxton went into business two years ago Brainstorm has played a major role in the business of the company.

'We use it for everything: project planning, program design, document drafting — in fact, wherever there is a need to organise creative thoughts and turn them into practical propositions,' said Tebbutt, who is as proud of Caxton's software baby as he is of his own flesh and blood children. Brainstorm was co-written by Tebbutt and Mike Liardet of Brainstorm Software.

Brainstorm is being launched as an 'ideas processor'. The name is designed to benefit from the goodwill earned by data processors and word processors in the past. The way Brainstorm 'processes' ideas is to organise them, which is why I prefer to think of it as an ideas *organiser*. Whatever you call it, as a new kind of software product, it presents Caxton with a marketing barrier which word processors and spreadsheets don't need to worry about. 'We'll have to use our advertising not just to sell Brainstorm but to educate potential customers about a new application,' said Tebbutt.

And reviewers, he might have added. Out of the window went Benchmarks and experience of similar products. My first job was to find out what Brainstorm was supposed to do; my second to see if it did it.

What does it do?

Remember the Gravox ad? The thing about Gravox was that it did everything 'all in one go'. In this case, the gravy is your thoughts and the gravyboat is Brainstorm. Pour your thoughts into Brainstorm, and Brainstorm links and structures them all in one go. Take a look at this piece of Brainstorm output:

BRAINSTORM BENCHTEST

- Introduction
  - paragraphs
    1. Quote
    2. Background
    3. Launch
- Body
  - — Sub-headings
    - What does it do?
      - Para 1. Gravox Ad.
      - Para 2. Brainstorm structured printout
      - Para 3. Tell them what they've seen
      - Para 4. Notice 'paragraphs' duplication
      - Para 5. Explain promotion and namesake
      - Para 6. Explain worksheets
    - How does it do it?
      1. If I only knew!
      2. What appears to happen.
    - How do you use it?
    - Other sub-heads to be determined
      - Illustrations and diagrams.
- Conclusions
  - paragraphs
    1. Quote
    2. Background
    3. Launch
  1. Usefulness?
  2. Originality?
  3. Competition?
  4. Value for money?

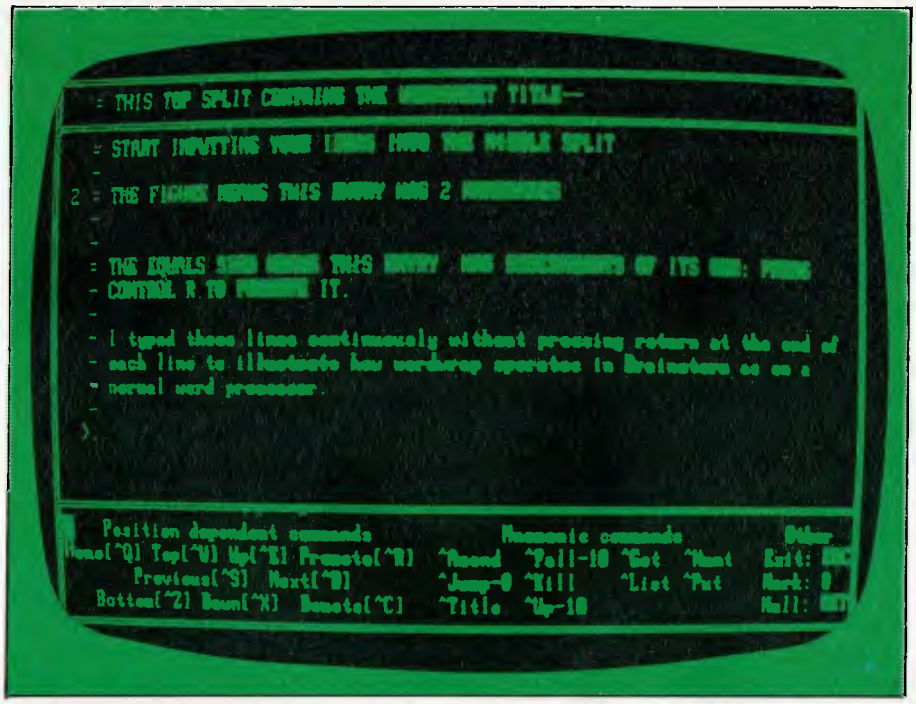
The plan above was produced in two minutes, from inserting the Brainstorm disk into the Sirius to tearing the printout from the Epson. It is a first sketch of this Benchtest and shows you that this paragraph will tell you about what you've just seen. So now you've been told.

Notice that the word 'paragraphs' appears twice in the printout: once under 'Introduction' and again under 'Conclusions'. Notice also that the three lines under the first occurrence also appear

under the second, before 'Usefulness?'. In fact, they were only typed once. Brainstorm noticed when I wrote 'paragraphs' the second time that it already existed as an entry. Whenever an entry in a Brainstorm file has a namesake (as such duplications are called), the program notices the fact. Depending on whether one or all of them have subordinate entries it then does its organising: more on that later.

Notice also that under 'Conclusions', 'paragraphs' has four other lines, 'Usefulness' being the first. You'll see that these four lines were not reproduced under the namesake. The reason is that they are not descendants of 'paragraphs', but exist on the same level. Descent, or subordination, is shown on the printout by indentation. All input to Brainstorm on the same screenful of data is considered to be equal in rank. As befits an equitable environment, however, any entry in any screen can be promoted to header status and be the leader of its own screenful of entries.

A screenful of entries is in fact more than a mere screenful: it can be up to 988 lines of text (on my 128k Sirius), upon which the large middle split of the VDU acts as a 15-line window. The top split contains the name of the officer in charge — that is, the header to that group of subordinates. 'What does it do'?' is such a header. The bottom split contains prompts and acts as a command screen. It also displays status information (see screenshot).



Commands are shown at the top of the screen and status information at the bottom.

How does it do it?

If I knew exactly how Brainstorm works I wouldn't be sitting here writing about it — so don't expect full details of the coding! What I can say is that it does its job extremely quickly, so quickly that the program doesn't intrude on your thoughts the way a word processor or a database might, by making you watch and wait while it carries out an instruction. Once loaded, Brainstorm resides in memory and requires no disk access except for SAVEs and LOADs of the model on which you are working.

What appears to happen, however, is that every time you press the return key after writing a line of text, Brainstorm assigns pointers to indicate where it belongs in the model. Brainstorm also scans the entire model looking for namesakes of the line you just entered. If they exist, they all get flagged with a number indicating the total number of namesakes to date. The flagging and the pointer setting is totally transparent — that is, it happens swiftly without you being aware that something is going on. In fact, when you get more than 15 namesakes, you do see all the numbers incrementing down the left-hand side of the screen but this takes less than a second. The manual is slightly misleading about the number of namesakes permitted, for it says: 'It is possible to have hundreds of occurrences of the same namesake all connected in this fashion.' This is not strictly true as although you may have hundreds, only 99 of them ever get flagged — more than 99 and they're all still flagged '99'.

Namesakes

If none or only one of the namesakes has descendants, Brainstorm regards each one as an image of the others and, if descendants exist, gives them all the descendants of the one which had them.

If, however, you create a unique entry with descendants and then change it so that it is then the same as another entry with a different set of descendants, Brainstorm checks with you that you want the two sets of descendants to be merged. If you type anything other than 'Y', the line is not entered and you must change it to avoid the merge.

Namesake matching can be a headache: you saw how the subheading 'paragraphs' in Conclusions above acquired all the descendants of the first occurrence. Upper and lower case distinctions do not apply when Brainstorm searches for namesakes. However, leading and embedded spaces are significant, so a good dodge to

distinguish between two entries of, say, 'paragraphs' is to type the second as ' paragraphs'. Trailing spaces are ignored. Another way of keeping same-meaning, non-matching entries apart is to choose a synonym for the new entry. You also need to be careful when you delete (or KILL) a header since all subordinate entries, if any, will also vanish. If what you want is to create namesakes easily, you can use an '*' wildcard (like the joker in Gin Rummy). The line '/I want to reproduce this line lots of times elsewhere in the model' can be copied wherever you want by typing '/*' and hitting return: the line beginning with the '/' is matched to the asterisked line.

How do you use it?

Imagine you have just decided to do something — anything! You begin to think about how to go about it. Inevitably your thoughts encompass many aspects of the task, from your own input to the organisation of other resources. Similarly you find that some aspects of the job appear in your mind in detail while others are more sketchy. In this initial phase of thinking about a new task, Brainstorm can be used as you might use a tape recorder or dictaphone. Instead of speaking your thoughts, you type them in as they occur to you. There is no need to set up records or define fields as you would do if you were using a database. You can save the file (or model) when you run out of ideas, and load it again when you want to add to the model. The advantages of Brainstorm over a tape recording are: a) there is no need for transcription; b) further input can be 'placed' at any point in the existing model; c) Brainstorm will make namesake links between matching input lines; and d) immediate structured print output can be obtained at the press of a button.

Having used the program as a flexible, intelligent notebook for fixing your ideas on the task, you may then use the model you have constructed as a basis on which to build a more detailed, formal document. In this sense Brainstorm is a kind of word processor. You select the part of the model you wish to expand and carry on writing.

Certain word processing features are *not* available: you can't set Brainstorm to double space automatically your entries on the screen (although you can arrange for it to print that way). There is no block and copy facility as such. The same effect can be obtained by creating a namesake of the header to which the block is subordinate at the place in the model where the copy is required. Another way of achieving this effect is to use the 'mark', an 'at' sign placed in the margin (see below for details). Each time text is 'got' from a mark, the mark is reassigned to the next line of text. By 'getting' again, the next line is moved to the target area. There is no search and replace function, although there is a search option. Only if the target is a namesake, can you search and replace by changing it: this changes all namesakes instantly. To establish a point of comparison I ran the *APC* Word Processor Benchmarks which could be used — saving and loading times — and the results are shown in Fig 1.

Good news, bad news

Two findings stood out while I was doing the Benchmarking. The good news is that

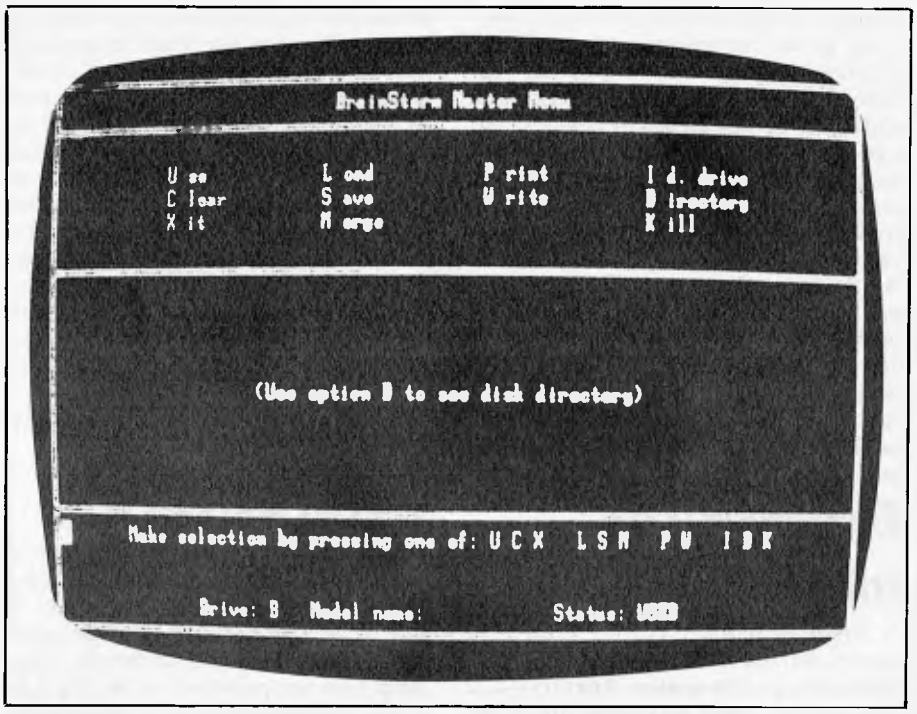
with Brainstorm you can jump to anywhere in the text without waiting for tiresome screen scrolling to get you there. This is because the entire model is held in memory and no disk accessing is required. The bad news is when you spot a mistake in the line above the one you are typing — a very common event — you can't just move the cursor to the line above and correct. Brainstorm regards each 72 character line as a discrete character string or symbol expression and the cursor may only be moved backwards or forwards within it during input. Word-wrap does operate if you are typing continuous text but to amend a line above or below the one you are typing you have to hit RETURN to come out of the line, reposition the line pointer to the line you want to correct, and then press ^A to get into it.

Installation and tailoring

My test disk was supplied ready 'installed' for use on a Sirius with a Z80 card. About 25 machines running CP/M are catered for: should you not have one of them, an install program is supplied on the disk to enable you to get started. MS-DOS is the first 16-bit system for which Brainstorm will be available at launch: no decision has been taken at the time of writing about implementing Brainstorm under CP/M-86. A large section of the manual is devoted to explaining how to use the install programs. Even if you don't need them to get going, you may want to customise Brainstorm for your own use. You can change the graphics used for the menu borders and choose different control keys if you don't like the given ones. You can write your own prompt messages, change screen and buzzer control sequences and specify paper size and print area. You can also reset printer codes for double or triple line spacing, character sets and error checking sequences. Whatever new configuration you invent, you save it onto an alternative command file on a backup copy of Brainstorm which, as a registered user, you are permitted to make.

Screen display

The Brainstorm displays are uncluttered and simple, and there are only two of them (excluding the 'welcome' display), both using the same format of a triple split screen. The main menu contains available commands (Fig 2) in the top split and status information in the bottom. The larger middle split is used to display directory information when required. The second screen display is the worksheet. Here the top split is a single line holding the worksheet header. The large middle split is the 15 line window on the model. The lower split acts as a prompt display and command field.



Using Brainstorm for ideas capture, the cursor takes refuge in the bottom split.

File creation and structuring

To set up a Brainstorm file (or 'model!') type U (for use) from the main menu. No RETURN is needed for any of the command keys. The cursor goes straight into the bottom of the worksheet screen. A line pointer '>' indicates which line you will use next time you enter text. This pointer can be jumped backwards and forwards over nearly 1000 lines in about a second! If you aren't word-wrapping (which you won't be if you're using Brainstorm for ideas capture), hit RETURN after each idea and the cursor takes refuge in the bottom split, ready to jump straight into the next line when you type the first letter of your next thought.

The Mark

If you are wondering why you need both a cursor AND a line pointer (I did), the answer is that the line pointer acts as a marker when you are jumping around the

model. You might want to mark a location (such as the Introduction header in my example) so that at any time during your flow of ideas you can jump straight back and add to it. You do this by typing an '@' sign. When you do jump, the '@' is automatically placed at the line you jumped from and the line pointer goes straight to where the '@' was. Next time you jump you go back to where you were. All this in a split second. However, only one '@' mark may be used; that is to say only one pair of lines can be linked in this way at any one time. This is no real problem because a wide range of other jump commands are included to get you swiftly from one part of the model to another.

Brainstorm model

A Brainstorm file takes the form of a model, defined as the sum of all the entries made during a Use session. An entry is a 72 character line which may be the title of the model, a heading, sub-heading, sub-sub-heading (upon their backs to bite 'em), and / or a descendant. Each line is, of course, a descendant of the heading under which it is entered. It may at any time be promoted to header status, as I mentioned earlier. There is no limit except computer memory to the number of entries or subordinated levels in a model. I got just under 1000 lines into my 128k Sirius, or else you could have 1000 levels each of one line! The normal kind of model will be somewhere inbetween. During text input the bottom split displays an edit menu. In 'idle' mode (cursor in bottom split) the level of the current worksheet is displayed plus the line number of the current line, the number of lines in the worksheet and the amount of free memory. A control key menu can be displayed by typing'!'.

Control keys

I said before that you can jump from top to bottom of a 1000 line model in a second. Top and bottom jumps are done with ^W and ^Z keys respectively — their north/south position on the keyboard. Other jump keys are provided — see Fig 3 for details. Assuming you don't change them, the other control sequences are mainly mnemonic or positional. ^H is used to enter search mode (H is for Hunt); ^J is for Jump, and so on. You can get text from an '@' mark or put text to one; both operations are useful when, having poured out your ideas, you start shaping them up.

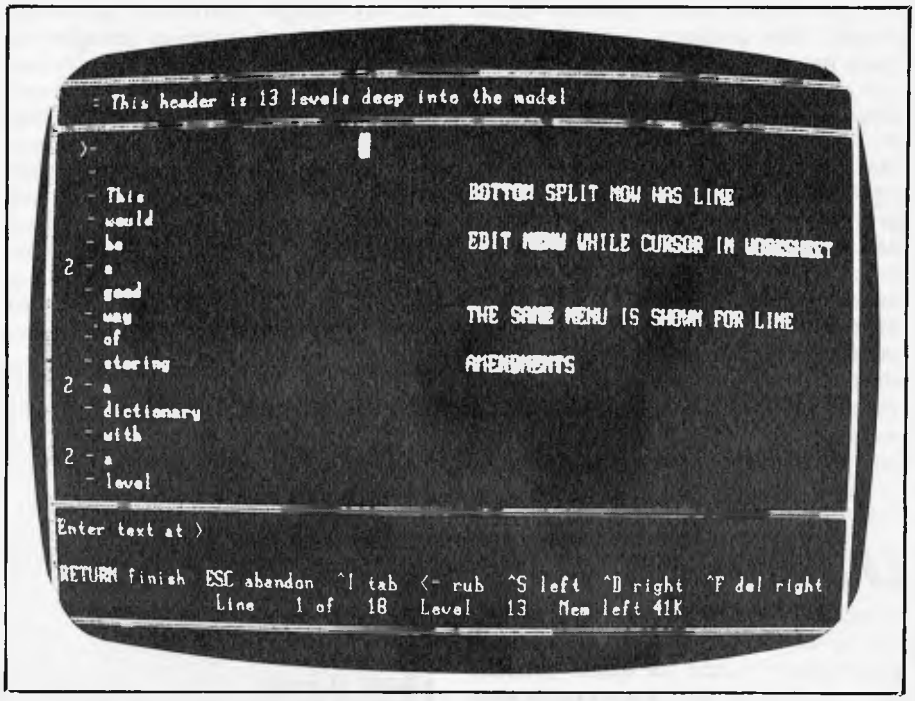
WordStar users will find some of the control key sequences familiar; for example ^S and ^D which glide the cursor left and right without overtyping. Brainstorm's ^A and ^F, however, are equivalent to WordStar's ^G and DEL respectively. The manual is a bit naughty to refer to 'single keystroke commands' since they all require the ALT key to be depressed. It's very frustrating when you forget the ALT because Brainstorm types a letter which you then have to delete (cursor inside an entry) or else creates a new line which you then have to kill (cursor in 'idle' mode). You also have to remember that the value of the control key changes depending on whether the cursor is editing or idling; for example, ^A gets you into a line for amendment, but inside the line it means delete character under cursor.

Hunt

Hunt operations may use the '*' wild card, commonly at either end of the target string to delimit it. Once again response time is

negligible and no appreciable degradation with model size occurs. Upper and lower case distinctions are ignored during a search. Unlike databases, Brainstorm has no 'high-level' search function using logical operators, but this is not really necessary given the speed of response: many potential targets can be evaluated in real time. Further, use of Brainstorm involves you in permanent interactive contact with the entire model, unlike a database-type model in which the records lurk out of sight among the circuitry. This means you have a far greater degree of familiarity with the model, and your knowledge keeps pace with it as it increases in size. You may also invoke a selection option when you request print output, using a marker to indicate the end of the print required or using the Hunt command to specify required headings, etc.

Any entry in a model can become a title or header if you position the line pointer opposite and press control R (Raise?). The moment any entry acquires subordinates, it is flagged in the margin with an '='. Non-header entry's rank is denoted by '–'. Control K is used to kill an entry (and all its descendants if it has them!).



The middle section of the screen displays directory information, when required.

Multiple files

Brainstorm can hold several models simultaneously, memory permitting. The manual illustrates this well with a Diary and Address book example, where two files are maintained and used at the same time. In fact, Diary is simply a sub-heading on the same level as Address book, and both could be thought of as discrete sections of a larger model — at least, this is how Brainstorm will treat them. Files can be merged from disk into current models: when this is done, Brainstorm immediately cross-references any namesakes between the two files. This has an important implication for future Brainstorm-type programs: I can imagine this approach being very valuable for building up expert-system knowledge bases.

Having mentioned the MERGE option, this is an appropriate moment to consider the SAVE, WRITE and LOAD commands. These are the only ones that require disk access. SAVE automatically defaults to a .BRN-type file, in which your model is saved in Brainstorm format and can be loaded back in this format for further work. WRITE saves an ASCII version of your model which can be accessed by other programs such as word processors or by operating system commands like TYPE. Conversely, Brainstorm will load ASCII files produced by word processors. These load at a single level as blocks or paragraphs of text. They can then be structured manually using commands such as PUT, GET, and PROMOTE, before being saved or used as Brainstorm models. Brainstorm will, however, forge any namesake-type links which may exist between entries. A section of the manual explains how to structure external files to correspond to Brainstorm internal format so they may be loaded as BRN files. I haven't yet worked out why anyone would want to do this, but it gives you a sneak glimpse of what Brainstorm gets up to behind that inscrutable screen.

I missed an option to run another program from within Brainstorm: it would be neat to be able to go into a word processor and then call up a Brainstorm-produced file for a final edit.

Output

There's an old saying in the computer world that if you put garbage into a computer you'll get garbage out. Brainstorm significantly modifies this adage: it's now a case of 'garbage in, *structured* garbage out'. The manual boasts no less than 2.5 million output formats based on the sawtooth indentation theme, as well as both continuous flow and word processor-type paragraphs without indentation. The manual accepts, however, that most people's requirements will be met from no more than 15 variations on the theme, and

the most popular one is made the default output. This produces successive four-space indentations and 'outdentations' as you go into and come out of lower model levels. The system of entering parameters to vary output is strangely complicated, bearing in mind the simplicity of use which typifies the rest of Brainstorm: I couldn't get the hang of it before writing this review and used the default output every time. Even with this poor show (I mean, using one out of 2.5 million possibilities says very little for my imagination), the output produced is extremely handy. The Brainstorm manual itself was composed using the program, while in the office I've used it to design the most exciting micro-users competition ever run in a micro magazine — details of which will be announced in a future issue.

User image

Brainstorm is a program to help you think and to set you thinking. I found using it challenging because its quick reactions gave me a feeling that it knew exactly what it was doing, but I didn't really know what I was up to. With word processors and databases you spend a lot of your time telling the thing what to do. With Brainstorm it's more a question of knowing what *you* are going to do — or think — next. To my surprise I found that the cumulative effect of using the program was to improve the way I thought: I am becoming more and more capable of organised thought with every Brainstorm session. This happened because from the word 'go' I found myself rehearsing a little snippet of mental aerobics at every press of the keys. It goes something like this: 'Does this thought belong here? If yes, slap it into Brainstorm now. If no, flick through the model and see if there's a home for it somewhere else. No home? OK, promote this thought to header status and give it an Empire to rule over.' To begin with I was angered at being made to feel inadequate, but it soon dawned on me what a change this feeling was from my usual 'stupid blankety-blank machine!' experience.

Now structured thinking is not a natural phenomenon. On the one hand, it could be said to exclude great creative leaps of the imagination but on the other, lack of structure has always been associated with second rate creativity. In the field of computer programming, the same principle is beginning to rule. There has to be a middle way between random, chaotic thought with its high creative content and

BRN format	
3000 words	
Load 12.8 secs	
Save 34.5 secs	
Full buffer (42k or 10,000 words)	
Saved 60 secs	
Load 34.1 secs	
Load degradation factor = 1	
Save degradation factor = 1.4	
DOC format	
3000 words	
Load 21.4 secs	
Save 35 secs	
Full buffer (42k or 10,000 words)	
Saved 60 secs	
Load 60 secs	
Load degradation factor = 1	
Save degradation factor = 0.7	

Fig 1 Brainstorm Benchmarks for Load and Save

Use	(Use a Brainstorm model or create a new one)
Clear	(the current model)
X	(Exit to system)
Load	(a file or model from disk)
Save	(to disk in Brainstorm format)
Merge	(current model with file/model from disk)
Print	
Write	(current model in ASCII format to disk)
Identity	(change ID of logged drive)
Directory	
Kill	(delete file from logged drive)

Fig 2 Main menu options — only the first letter needed

Amend entry	^A mend
Amend title	^T itle
Delete entry	^K ill
Cursor up	^E
Cursor down	^X
Cursor up 10 lines	^U p
Cursor down 10 lines	^F all
Cursor to top of list	^W
Cursor to end of list	^Z
Title screen	^Q
Promote an entry	^R
Demote an entry	^C
Previous namesake	^S
Next namesake	^D
The mark	@
Jump to mark	^J ump
Get from mark	^G et
Put to mark	^P ut
Search for an entry	^H unt
Print current list	^L ist
Edit Controls	
Cursor left	^S
Cursor right	^D
Delete left	^A
Delete right	^F
Tab	^I or TAB
Complete entry	<ret>
Abandon entry	<esc>

Fig 3 Standard edit commands

ordered, structured thought which is high on communication power. Brainstorm is a good middle way.

Leaving the psychology of creativity for you to argue about among yourselves, I found that when I messed things up Brainstorm is well equipped to sort you/me out again. 19 textual error messages, including a friendly 'Sorry', and a novel 'Unsure' (not what I expected from a program with Brain in its name) are available on screen, with backup information in the manual. For those unexpected hardware and operating system crashes Brainstorm has its own 'salvage crew' aboard, a program (!) called Rebrain. I'll explain the screech mark in a moment. According to the manual, if you use Rebrain immediately after a crash it offers a 'high probability of recovering' the model you were working on. I looked forward to trying this out and engineered a spectacular power surge which shut everything down for a nanosecond or two. Unfortunately, when I tried to 'Rebrain' my way back to life, nothing happened: the Rebrain program was missing from the disk. When I called Caxton to complain I was told how to write my own Rebrain program: you simply create a file called, say, Rebrain (anything else will do). When you then call the program, it loads zero bytes and branches to 100H, where the first instruction of Brainstorm resides. The model should still be there. I used 'Pip' to create the file by typing 'PIP REBRAIN.COM=CON:'. This makes the console the input device. I answered the prompt with a control Z to give an empty file. I then tried to save a model with the drive door open: crash! The door closed again, I hit ^C to reset the offending drive and call the empty .COM file. This reset the pointers in the transient program area to the start of the last program to reside there; in this case Brainstorm itself. The model was intact, but I didn't get that 'Unsure' message promised by the manual. Most disappointing.

Documentation

My manual was a pre-production version, but the retail version will come in a gold slip-case together with the disk. There were some 90 pages of manual, only 34 of which were used to teach me how to use all Brainstorm's facilities. I mastered them all in two half-hour sessions — all that is except for the print formatting codes which I'm still struggling with more as a point of honour than because I need 2.5 million options. So few instructions reflect Brainstorm's ease of use: I honestly didn't need any more help than what was offered. Of the other 56 pages, three or four contained error message and command key references. I'm told that the user will get a fold-out reference chart: I didn't. Since all the reminders you need can be had from the screen it didn't seem a vital section anyway. One page describes how to 'Rebrain'; 26 are devoted to the installation procedures, with five pages appearing twice, once in the section called 'Getting Started' and once in 'Installation'. The remainder are shared between a five page appendix on how to create Brainstorm format files externally, some diagrams of screens and an ASCII/Hex 7 bit converter chart. Last, but most interesting of all, no less than 18 pages of ideas for using Brainstorm: an excellent inclusion to help get this new product off the ground. This section includes a listing of the Diary/Address book program for you to type in and run.

Money matters

Having laid out a few thousand for your hardware and bought a word processor and/or a database for several hundred, you probably won't flinch at paying around $600 for Brainstorm. I believe it could have been sold for less: Caxton would have loved to have sold it for more. In the end the price is Caxton's attempt to place its product into the market at an 'attractive' price.

There's certainly no question, at the moment, of having to fight off the opposition: Brainstorm is the first, and so far the only product of its kind. I'm quite sure it won't be the last. As the founder of what is going to be an applications dynasty, Brainstorm will have to do all the work of winning a market share for this kind of program. For that reason, Caxton is not resting on what it hopes will be laurels. The next products based on the Brainstorm philosophy are already on the drawing board — or rather, in Brainstorm files!

Conclusions

This is a new kind of tool which every micro user could find a place for. Its usefulness is not in doubt. My main disappointment is the price, but I suspect that's just because I couldn't afford to buy it myself. If you can afford it, Brainstorm will do three things for you: increase your ability to communicate with your staff and colleagues on paper; increase your ability to control and exploit your own ideas; and gradually train you to think in a more structured fashion if and when you need to. More control over the innovative instant namesaking process could be introduced — in particular a menu which would allow the user, in a particular Brainstorm session, to ask the program to accept a namesake without giving it all the descendants of the others.

Bearing in mind that the program only occupies 14k of RAM and requires no disk access during use, Brainstorm is an ideal candidate for use with cassette I/O. This would bring thousands of home micro owners with memory expansions into contact with the kind of program usually reserved for business machines. So come on, Caxton, let's have a sub-$100 cassette version later this year.

Caxton's products are distributed in Australia by Imagineering.

END

NEWS EXTRA

Sticky fingers solution

Aztec Electronics has come up with a product to fight the growing problem of "sticky fingers" in the micro business. It consists of one or two flexible steel cables attached to one or two square adhesive backed, aluminium plates. "Hold-it" is intended for use with computers, printers and disk drives but can also be used for typewriters, calculators and other business and personal electronic equipment. It's priced from $29.95. Telephone: (03) 579 0011.

Coals to Newcastle

Typequick, a Sydney-developed program which teaches touch typing has been launched on the US market. It is expected 50,000 units will be sold in the first year as a result of a $100,000 advertising campaign due to start this month.

Noel McIntosh of the unfortunately named AID Systems said that "Typequick was designed to improve productivity in the office" on the basis that "most businesses find their accounting staff's productivity will decrease when the micro is installed until the clerks can type faster than they can write".

Farming cash flow

Country Soft in Western Australia has announced a cash flow and budgeting program for farmers. The program requires an input of a 12 month budget for the farming year (there are 25 codes available for income and 70 codes for expenditure items); cash flows in and out as they occur; and physical data as it becomes available. From this data, the available output includes a statement of cash flow of the business, a comparison of actual versus budgeted cash flow and a reconciliation statement.

Country Soft also sells a 'milk distributor's package', a 'bread distributor's package' and a general distributor's package.

Details on (09) 362 6416.

News in brief . . .

Osborne Computers has a new distributor in Australia: Osborne Sales Centre (Aust). The contact 'phone number is (02) 290 3344. A new product has also been announced: it's a RAM disk of up to 384k capacity starting with a price of around $600 . . .

Data Peripherals has announced the release of a new four user computer system — the TeleVideo TS804. Three operating systems are available: MP/MII, Oasis and CP/M Plus. It runs on a Z80A cpu with 320k of RAM. A price of $6,995 (excluding sales tax) includes MP/MII and a 10Mb hard disk.

AutoCAD for NEC APC

Entercom Computer Co. has

released a two dimensional computer-aided drafting and design system for NEC's Advanced Personal Computer. It is a general purpose system suitable for a wide variety of applications, including areas as diverse as architectural drawings and chemical engineering. A sketch facility allowing free-hand drawings via a digitizer makes the system most suitable for graphic artists as well.

Other input devices include the Hitachi Tiger Tablet, Houston Instruments' pads, the Numonics Tablet and two varieties of mice. A large number of plotters from such manufacturers as Hewlett Packard, Houston Instruments and Alpha Merics are suitable output devices.

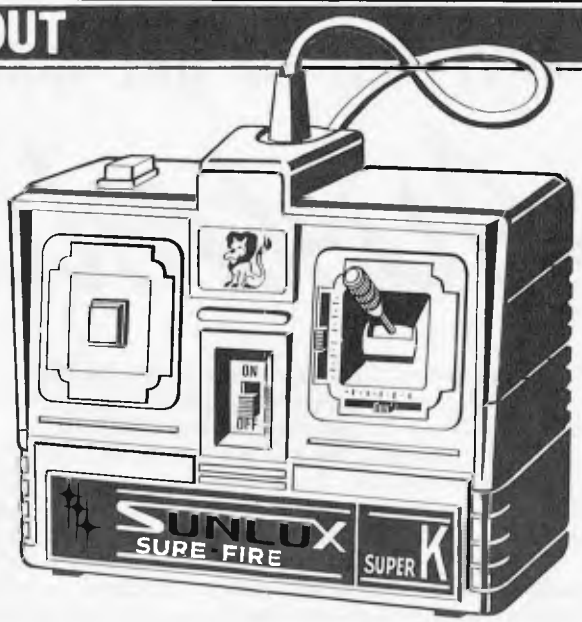
A large set of editing commands allows drawn objects to be moved, copied, modified, erased, rotated, mirrored, and scaled vertically and horizontally. Repetitive patterns can be generated in either a rectangular or circular array.

A bi-directional zoom facility allows working on a drawing to any level of detail.

A disk directory of the hard or floppy disks can be viewed at any time and a file search facility is available. Utilities supplied with the package can convert drawings to or from an ASCII text file. This allows user programs such as word processors, data bases and high level languages to interface to AutoCAD.

Finally, help menus are provided and the user may request information on any command. All help menus can be edited or new ones constructed.

Further details are available from Entercom on (03) 429 5883. END



Manufacturers of games peripherals appear to be gaining a greater appreciation of the lengths (and costs) to which people will go to increase their performance in that illustrious arena of the video game. Take, for example, the product pictured above from Lion Electronics in Western Australia. The "Sunlux Sure-Fire Super K" sports two fire buttons: one, a manual fire button for precise bombing runs and the other presumably for, say, a tail gunner with its four shots a second. It also has an on/off switch. The Super K is suitable for Commodore, Atari and Apple machines. Details on (09) 274 4519.

How not to get lost at the

Australian Personal

Those of you who are itching to know who's attending the APC Show will be pleased to see the complete list, along with the floor plan, published below.

As you can see the variety is enormous. Nearly 80 exhibitors are present. And all the big selling computers will be in evidence: VIC-20 and Commodore 64, IBM's PC range, Atari 600 and 800, DEC's Rainbow, Apple's MacIntosh . . .

Don't forget Wednesday, March 14 is a "business day" and you'll need to present a business card to gain admission.

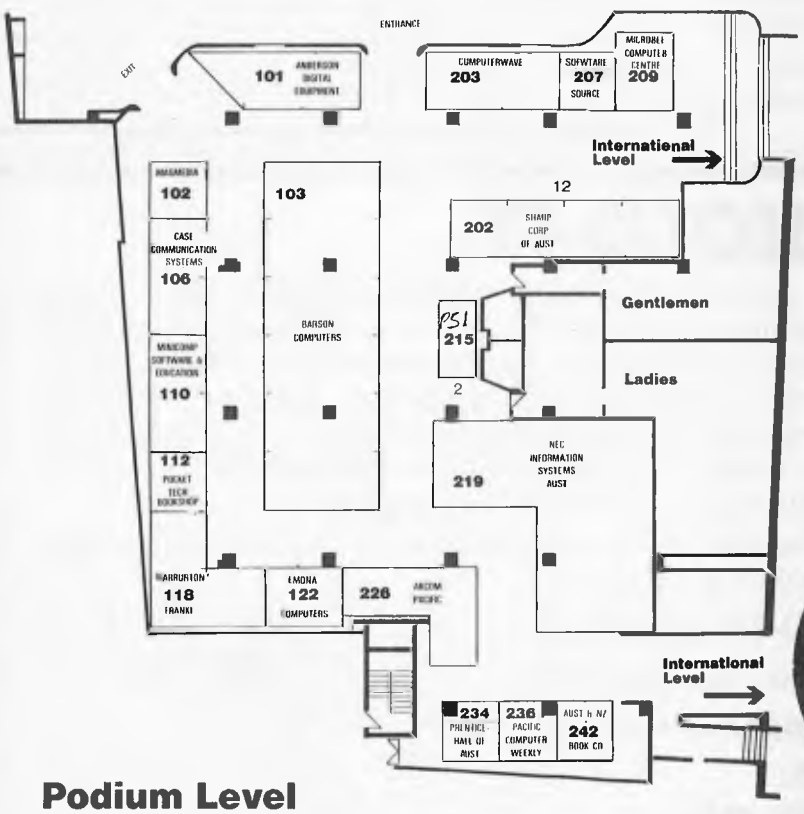
A new feature of this year's Show will be the staging of four audio-visual presentations on the hour, every hour, during the four days. A team of Coopers & Lybrand micro experts have been retained to stage the free presentations. Each has been designed to provide visitors with information on how to use the Show constructively and will provide a practical understanding of the commercial benefits that can be derived from the new microcomputer technology.

There will be four separate topics — each 3-5 minutes in length — during each session. These topics are "How To Use The Exhibition"; "Hard decisions" — decisions to consider when choosing hardware; "Soft Options" — outlining the various options for software; "Education" — aimed at the use of microcomputers in education. The education presentation will be run in conjunction with publishers McGraw-Hill, specialists in the education field.

A competition will be run in conjunction with the Coopers & Lybrand seminars which will offer visitors the opportunity to win a Rainbow 100 system, donated by Digital and configured with the appropriate operating system and application packages.

Admission to the Show on the three general public days is $4 for adults (unless you spot the discount voucher in the Show advertisement in this issue) and $2 for children.

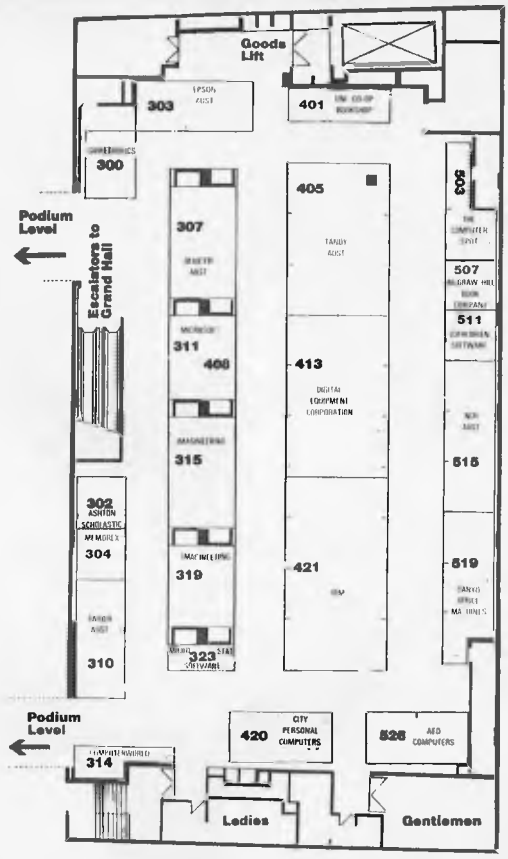
So we'll see you there. And we hope you're all looking forward to it as much as we are!



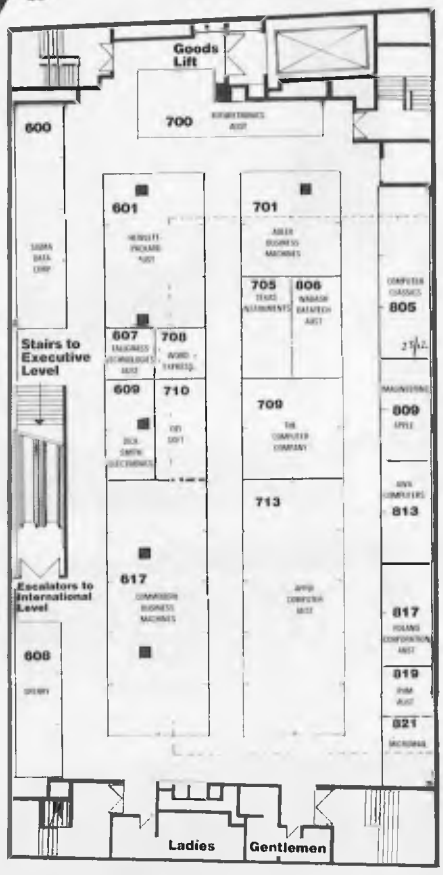
Podium Level

See yo

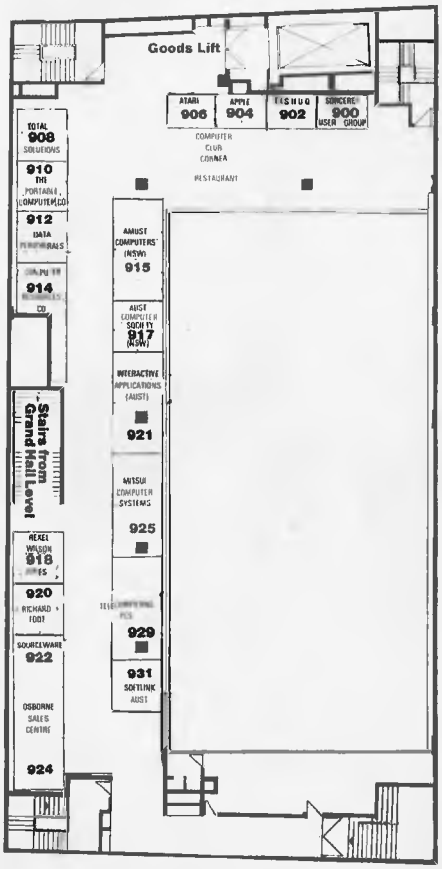
Computer Show... u there!



International Level



Grand Hall Level



Executive Level

BENCHTEST

COMMODORE 720

After a series of false starts and problems, the Commodore 700 range of business machines has finally arrived. Mike Liardt examines the 720 . . .

Who says that computing is a sedentary profession? Not when you've got a Commodore 700 to review, it isn't! Having arranged to take delivery, at my flat, of the aforesaid machine I was somewhat disconcerted when the delivery man unloaded three small wardrobes at the front door. Anyway after much wheezing, heaving and puffing your chronically unfit reviewer finally secured the three items in his dining room.

Right – now for the unpacking! More wheezing, heaving and puffing and eventually a Commodore computer, with 8250 disk drive unit and 6400 daisywheel printer were perched on my dining room table. And with not a few boxes and polystyrene fillers strewn all around the floor. Well full marks to Commodore for packing, especially for the printer which was in a box within a box – I half expected it to be like those Russian dolls, with a diminutive thermal printer emerging at the very last!

Pausing, only to recover my breath and stack all those boxes out of the way, I decided to take stock of what lay before me: at the heart of the system is the Commodore 720 computer itself – this is the really new component of the three, and we have actually been waiting nearly a year for it to arrive. It consists of a detachable keyboard, main box containing the processor, 256k of RAM, Basic in ROM, and has a monitor secured on top of it. Other members of the 700 series have less RAM, or no monitor. Theoretically, at least, it is possible to use this unit without disks, and just with a cassette tape drive, but at a price around the $2300 mark, this sort of configuration will not be causing competitors any sleepless nights.

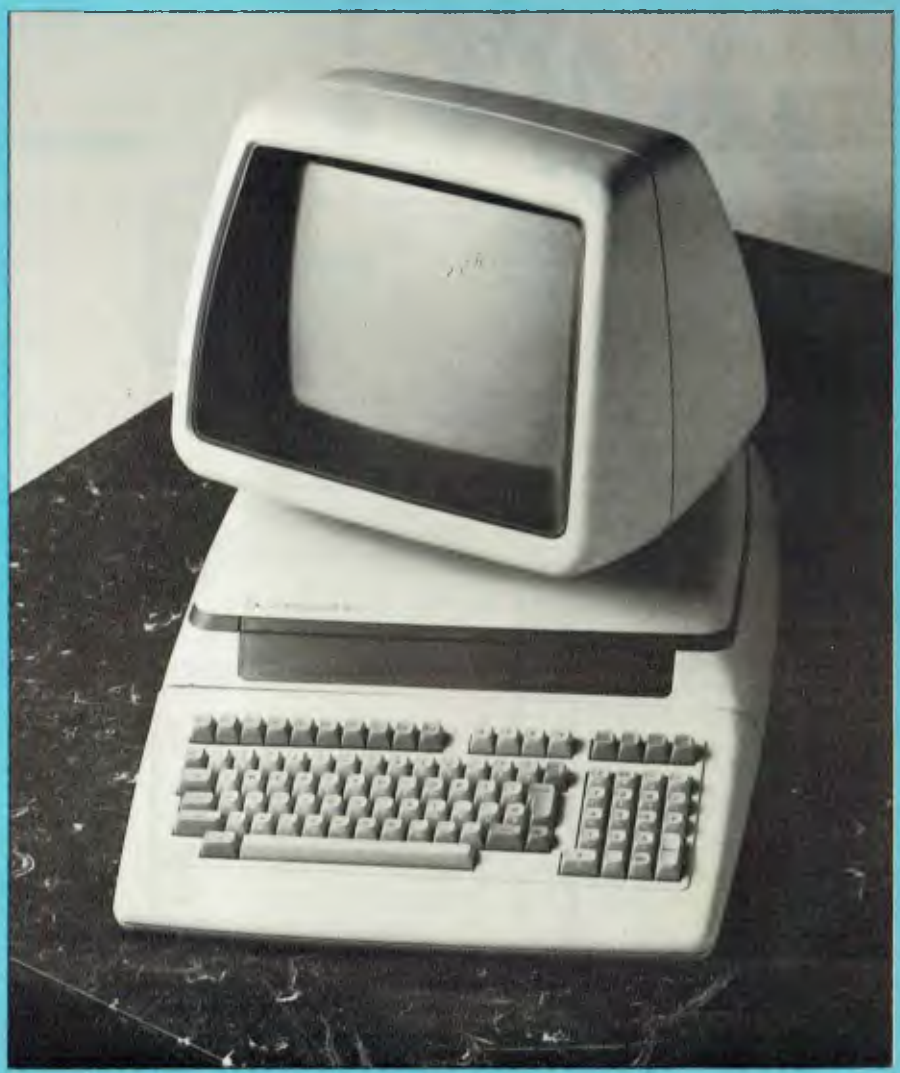
The second unit contains two one megabyte disk drives. Externally it is very similar to the disk units that Commodore has been manufacturing for some time, but the capacity has recently been upped to a million characters per drive. The third component in my review installation was a Commodore 6400 daisywheel printer, actually a TEC F10-40 with a Commodore label, but of course just about any other type of printer could have been substituted for it.

Finally, the total cost of this unaccustomed load on my dining room table amounted to about $7,000 including sales tax.

Exploring the 700

Readers will get some impression of the 700's appearance from the photographs. The 700 seems to be quite photogenic, and this is not a compliment: it does not look as graceful 'in the flesh' as it does in the photos. I think this is because it is actually a fair bit bigger than you would expect.

Hardware reviewers are currently fond of referring to 'desk footprint', the desk



The Commodore 720: a Mostek 6509 processor, 256k RAM and Basic in ROM.

space consumed by a machine. Well, the 700 has got big feet! It is roughly the size of an IBM PC, but unlike them, this does not include the disk drives, which are housed in a large separate box.

The keyboard is detachable and connected to the main box by a plug at the end of a coiled flex. You need very nimble fingers to insert this plug, as its socket is awkwardly placed, but the 700 is not a portable machine so you are unlikely to be doing this very often. The keys themselves are well laid out and have a good feel to them. I should imagine touch-typists would feel quite happy with them. There are 94 keys in total, including all the keys you would expect, and a few that you would not. There is a separate numeric keypad, row of function keys and arrow keys in addition to a fairly standard qwerty layout. The front of most of the keys is embossed with graphics symbols. These graphics characters, identical to the PET's, can be typed directly when in graphics mode: a single key toggles between upper/lower case mode and upper case/graphics mode. On the number keypad there is a key marked with two zeros, and pressing it generates – you've guessed it – two zeros. Other unusual keys include one marked 'π', and another marked 'CE' for rapid 'clear entry' on the numeric keypad.

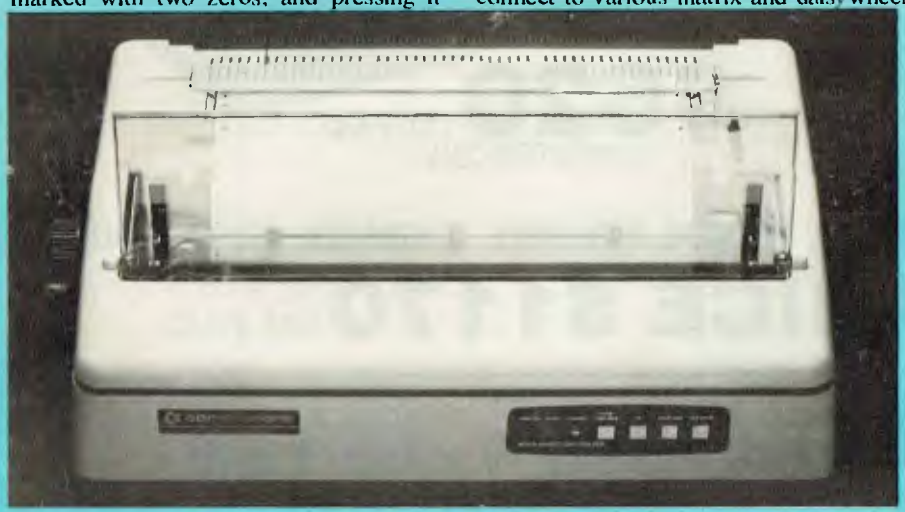
The monitor is firmly fixed to the main processor box, but can be swivelled and tilted to your preferred angle of view. The 12½ in screen is somewhat 'set back' in its case – rather like a lens surrounded by a lens-hood. This obviously helps shield it from reflections, but looks rather inelegant. The screen surface is anti-glare, and this seems to work quite well. I used it, with my back to a window, without any trouble.

The display itself is a restful green phosphor, 80 characters wide by 25 rows high. This is one row more than most VDU displays, so the extra row can be usefully employed for system status messages, etc.

Moving round to the back are reset and on/off switches, a 240 volt mains socket and several interface 'ports' for connecting the 700 to other devices. In particular, its IEEE-488 interface can connect to a range of Commodore disk units: from a 165k single floppy drive right up to a 7.5 megabyte winchester disk. It can also connect to various matrix and daisywheel printers. Although there is only the one output socket, it is possible to connect to more than one device by 'piggy-backing' the plugs. There is also a cassette port which, along with the IEEE-488 port, is not a proper socket, but an edge connector from the main circuit board. You might expect this sort of thing on a cheap $200 machine, but not on a $2500 one. Finally there is an RS232 port and audio video outlets. It is a bit surprising to find a sound facility on a business machine – sound effects being usually confined to games software, but doubtless a hard-worked businessman would like to relax with some ear-splitting arcade game at the end of a hard day.

Undoing two bolts at the back allows the top of the main case to hinge forward, monitor and all. Actually, the bolts were missing on my review machine, but normally you will find them there. Unfortunately there is an earth-wire from the top of the case to the bottom, and this has to be unfastened before the case can be fully swung open.

At the bottom of the case lies a single circuit board, about the same size as a tabloid newspaper, but just printed with component identifiers and no sign of a page three anywhere. The larger chips are socketed, and right in the centre lies the Mostek 6509 processor. This processor is compatible with the well-known 6502 that has driven a whole generation of home computers, including the PET and Apple II. The main difference between the 6502 and the 6509 is that the 6509 has two extra instructions that can be used for accessing memory outside the normal 64k limit. Thus



The 6400 daisywheel printer; actually a TEC printer with a Commodore badge.

Ninety-four keys — including some you wouldn't expect.

Slick styling, but no integral disk drives.

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the 700 can be equipped with 356k of RAM, and with a theoretical expansion up to 896k (when Commodore get round to building the RAM boards).

Getting started

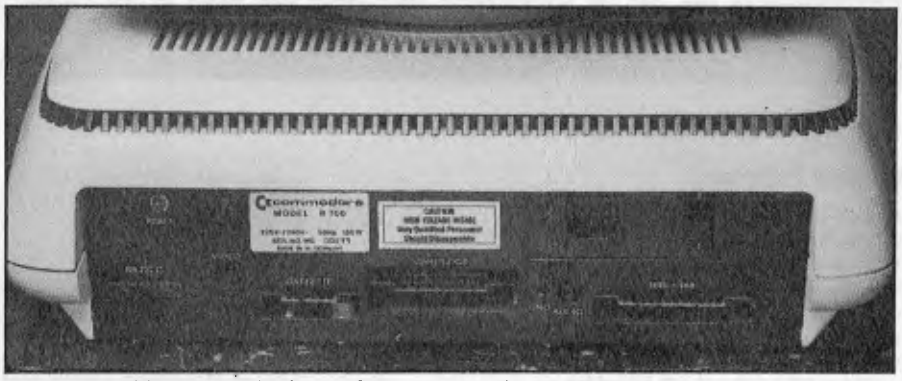
Ever since the PET was first introduced, back in 1979, Commodore has had an unenviable reputation for providing poor documentation, and the signs are that the 700 will not be an exception to this rule. Currently the 700 has to share its documentation with the 500 and 600 series, in a manual of just 113 pages covering all three systems. Naturally there is just not the room to impart enough information in this limited space. Evidently a new manual is on the way, but I was unable to find out any more about it, and with Commodore's reputation in this department it is a fairly forlorn hope that it will be a substantial improvement when when it does arrive.

Anyway, once the system is unpacked, the three components need to be wired together using the very stout cables and connectors supplied. The back of all three have IEEE outlets – proper sockets on the printer and disk drives, but on the 700 itself there is just an edge connector from the main circuit board. One cable connects the 700 to the disks and the other connects the disks to the printer. This latter connection must be secured 'piggy-back' fashion to the plug already in place at the disk drives, since there is only the one IEEE outlet available there. This connection is securely bolted in place, so there is no danger of it coming loose or making poor contact.

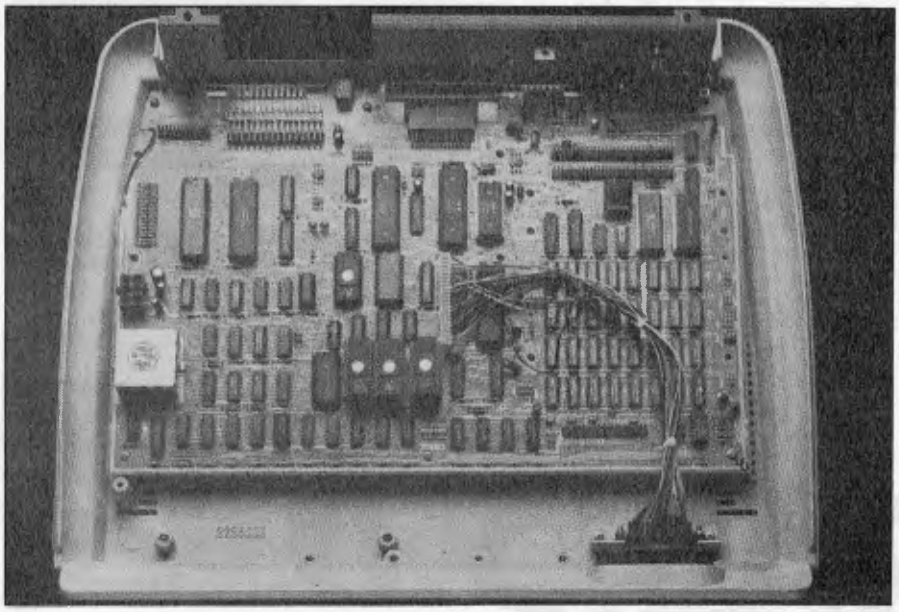
Each unit needs its own power supply, so after fitting three mains plugs comes the big moment – hide behind the couch, fingers in ears and switch on! Actually after switching on you are greeted with total silence – not even the sound of a disk drive whirring in order to boot up the operating system.

And at this point I hit my first problem: I had inserted Commodore's Demo disk in the drive (main drive is on the right, not the left like all other systems I have seen), but I was totally unable to access its disk directory to discover what files resided upon it. In addition to this I was a bit perturbed that the system had not booted up when I first switched it on. Perhaps there was something wrong with the disk drives? Needless to say the manual was not very helpful.

In fact, it transpires that the operating system does not need to be booted when the machine is first switched on, as it is already 'burned in' in ROM – an unusual feature for a machine in this price bracket, but neither advantageous nor disadvantageous. The other problem was caused by the manual failing to explain the correct syntax for the disk commands. In fact the CATALOG (printed in the manual in upper case) command is needed to see the contents of a disk, but this should actually be typed in as "caT" – quite elementary when you know how!



The 720 could theoretically be used as a cassette-based machine.



The 6509 processor allows up to 896k RAM to be addressed.

Programming language

Currently the 700 has only one programming language available: Basic. Other languages are being promised: Pascal, Forth, Prolog and Logo, but they are not available here and now.

The Basic is active as soon as the machine is switched on, and is available independently of the disk drives. In fact the Basic interpreter is embedded in 28k of ROM. This version of Basic includes commands to access the disk drives, if they are there, and contains a few extra commands, not available in most Basics:

★ **BANK** – This allows the Basic program to operate in more than 64k of RAM. With a full complement of RAM there are 16 'banks' available, each of 64k. This command only operates in conjunction with a few of the other Basic commands, so it is still quite a problem to write programs that need more than 64k of RAM.

★ **TI$** – It is possible to access the system clock through this variable, to an accuracy of one tenth of a second, thus introducing automatic timing to your programs.

★ **KEY** – This can be used to assign functions to function keys.

★ **PRINT USING** – This command greatly facilitates numeric formatting.

★ **BACKUP** – This is a disk command that can be used to copy disks.

Apart from the above, the Basic appears to be fairly typical. Although the 700 has fairly sophisticated sound generation facilities, a 6581 chip permitting three separate voices of nine octaves each, there are no Basic commands (documented) with which to access it, so any sound effects have to be implemented in machine code.

Benchmarks

At this point, I decided to run the APC Basic Benchmarks. The Basic interpreter is permanently resident in ROM, so there is no need to load it from disk – it is there and available as soon as you switch on. Praying that there were no peculiarities in the 700 version of Basic (after all I was sure the

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manual would not bale me out if there were), I keyed in and timed all eight test programs.

In the event the 700 Basic caused no problems, behaving much like any other good version of Basic. The times were quite respectable too (see Benchmarks table). Referring to the summary of Benchmarks (elsewhere in this issue) which describes the tests and lists the results for 59 machines, the Commodore 700 would be 17th.

Software

It is often said that it is software that really sells machines – for example, the VisiCalc spreadsheet system is generally acknowledged as a major reason for Apple's phenomenal success with the Apple II. Certainly I would advise anyone contemplating a computer purchase to look for the software first, then choose from the machines that will run it. So what incentives does Commodore provide for buying its machine?

On the accounting side, there is the standard Commodore packages including the usual debtors, creditors and general ledger. These are the same as those supplied on the old 8000 series machines although they have been revised and are now stamped as version 7. Apart from this Commodore also have Superscript II, SuperBore and Calcresult as wordprocessor, database and spreadsheet packages respectively.

The main items missing from the above list are the magic words CP/M, MS-DOS and CP/M-86. Nor will you find the slightly less magic words UNIX or UCSD. For the benefit of the newcomer, let me explain that these are the names of industry standard operating systems, available on a vast range of microcomputers, and roughly in the order I have given each providing the key to a huge choice of software.

Commodore, like its rival pioneer of the personal computer, Apple, has steadfastly refused to adopt any of the standard operating systems, and arrogantly persisted with its own. The Apple III was launched without access to CP/M, and was something of an anti-climax after the Apple II. And so, a couple of years later, the question is: Is Commodore simply going to repeat Apple's mistake?

To a certain extent it is hedging its belts. As I have already mentioned, the circuit design for the 700, based around a Mostek 6509 processor, includes provision for a second processor. This will be either a Zilog Z80 or Intel 8088, running concurrently. These processors are an essential prerequisite for running CP/M or MS-DOS and CP/M-86. However, Commodore has not exactly left a spare socket simply to drop the processor into. And these operating systems do actually need to be modified to work on the 700. So you cannot just go out and buy a Z80 chip and a CP/M disk – Commodore needs to put a lot more work in first! What all this does mean is that these operating systems *might* be available one day, and the Commodore can mention them now in its brochures.

(Editor's note: Since this Benchtest was completed, Commodore has announced an 8088 board which will sell in Australia for $558 and will allow the 700 to run CP/M-86 or MS-DOS. The operating systems are expected to sell for around $300.)

A tale of two disk drives

The 8250 disk drives supplied with the review machine worked reliably enough and provided two megabytes of storage which is above average for 5¼in floppies. They are, however, housed in a sharply angular box. Doubtless this box blends in well alongside Commodore's PETs and 8000 range, which have similar angular features, but sticks out like sore thumb when placed next to the rounded 700. Fortunately, Commodore has redesigned the cases with its recently released slimline version of the 8250. It also stores one megabyte per drive but wasn't available in time for this review. Watch out for it on Commodore's stand at the APC Show in March.

The 700 was originally planned to have internal disk drives, and indeed many of the illustrations of it show these drives in place. Certainly the main box of the 700 has enough space for a pair of disk drives – that is one of the reasons it is so large, but evidently Commodore has got cold feet on this idea. If this is the case then it is a great pity since it leads the 700 way off from the existing market trends towards transportability and elegance.

Prices

(Including sales tax)	$
610 – 128k RAM without monitor:	1116
710 – 128k RAM with monitor:	2046
720 – 256k RAM with monitor:	2325
8250 – 2x1 megabyte disk drives (slimline version):	2046
6400 – daisywheel printer:	2604
1361 – dot matrix printer:	1023

Conclusions

For a machine that has now been launched, there are still a surprising number of essential features and facilities not yet available on the 700. At the time of writing this review we are still awaiting new manuals, CP/M and MS-DOS options and programming languages other than Basic.

I would advise anyone thinking of buying a 700 to wait and see if these problems are sorted out. Until such time as these extras are available the 700 does not have a great deal to offer. A particularly weak point is that it does not (yet) offer any of the standard operating systems. I know Apple's Lisa may very well succeed with a non-standard operating system, but this is because that machine has so much to offer. Commodore's operating system is very rudimentary in comparison.

My final word to would-be purchasers is: Wait! And if you can't wait then take a good look round at the opposition.

Benchmarks

BM1	1.1
BM2	6.5
BM3	12.0
BM4	12.3
BM5	14.2
BM6	22.1
BM7	35.3
BM8	7.2
(or 72 secs for 1000 iterations)	
Average	21.94

All timings in seconds. For an explanation of the Benchmark programs, see the Benchmark summary elsewhere in this issue.

Technicial specifications

Processor:	MOS6509 (602 compatible).
Memory:	256k (Model 720), 128k (710 & 610).
Screen:	12in green phosphor. 25 lines of 80 characters, each defined on 9 x 14 matrix. Full ASCII character set plus 64 graphics characters available.
Keyboard:	94 keys, qwerty layout, 10 function keys, numeric keypad and arrow keys.
Disk:	Range from single 5¼in (164.5k), through 2 x 1 megabyte 5¼in (8250 drives used in review), to 7.5 megabyte winchester. Connected via IEEE-488 interface.
Interface:	RS232C, IEEE-488, cassette, cartridge slot and audio and video outputs.
Language:	Basic.
Dimensions:	Keyboard – 450mm wide x 245mm deep. Main unit – 460mm wide x 350mm deep x 460mm high.

A BEGINNER'S GUIDE TO PROGRAM CONVERSION
PART 2:SIMULATING STATEMENTS

In the October issue of APC Surya looked at the factors to consider when choosing between a program conversion and a complete rewrite. In the November issue he followed that up with the Basic Converter Chart and now he continues the series on the conversion of one Basic dialect to another with the assumption that a conversion is appropriate and analyses the procedure in detail.
Next month Surya will continue with a look at graphics and sound conversion.

The initial steps to be taken when converting a program from one dialect of Basic to another are much the same as when coding from scratch and just as much discipline is required. The starting point in either case is to have a clear understanding of what you're setting out to achieve. Make sure you can follow the logic of the program before you attempt to modify it. Spend a little time working out why the author has done things in that particular way. All this may seem unnecessary at first, but it's time well spent: the greater your understanding of the program, the easier the conversion will be.

Once you're satisfied that you have a clear overview of the program as a whole, you can look at each section in detail. Break the program down into its component subroutines. This is only possible with a reasonably structured program, but as mentioned in the October issue, programs with poor or non-existent structuring are best left alone.

When examining each routine, take a special look at the variables. Determine which are global and which are local. Global variables are those used throughout the program. Typical global variables include scores in games, some counters, printer-settings and so on. Local variables are those whose values are used only within a given subroutine: once the routine has been exited, the values are no longer required and the variables may be used for a different purpose within another routine. Typical local variables are counters in FOR-NEXT loops and flags used to check validity of data.

The reason you need to distinguish between the two is that local variables may be freely changed or discarded as appropriate, but global variables need to be treated with a great deal of care — the program as a whole is dependent upon them. If you're lucky, the programmer will have gone to the trouble of listing all global variables in remarks at the beginning of the program, and used fixed local variables so that, for example, w is always a FOR-NEXT loop counter. Failing that, there are utility programs available that will locate variables for you.

Coding

(Note: in the examples given below, I am using A$ to represent any string variable and 100 onwards whenever line numbers are required. These choices are purely arbitrary and have no significance.)

During the process of converting a program from one machine to another, you will very often come across a keyword in the original program for which your machine has no equivalent. While experienced programmers will soon find a way round the problem, those a little newer to the game may find themselves stuck for a solution. What I have done below is to look at some of the common offending statements and methods of achieving the same effect using standard Microsoft. The keywords covered are not in any particular order.

INKEY$: This statement is an almost statutory presence in just about every Basic program ever written. This statement tells the computer to scan the keyboard to test for a key depression and place the result into a specified variable. The standard format is A$=INKEY$; the most common variations are A$=GET$, GET$=A$ and GET A$.

The statement takes one of two forms. On most machines, the processor will carry out a single sweep of the keyboard: if a key is pressed during this scan, the value of the key pressed will be placed into the variable A$. If no key is pressed, A$ will be null (empty). On some machines, however, the computer will carry out a continual series of sweeps until a key-press is detected. A few machines offer both forms.

A continuous scan using the former version of inkey$ is straightforward: 100 A$=INKEY$:IF A$="" THEN GOTO100. The BBC, however, goes a step further in offering a timed keyboard scan in the form A$=INKEY$(time), where time is given in 100ths of a second. To simulate this using the standard INKEY$ statement, we use a FOR-NEXT loop thus: 100 FOR A=0 TO (value):A$=INKEY$:NEXT. The value of the variable will need to be adjusted to suit. Since different machines have different processing speeds, you'll have to experiment with different values to establish some kind of relationship between the value of the FOR-NEXT counter and real time.

Of course, the example given above would return the final key pressed if there were two or more key depressions during the scan period, but this is easily overcome:

```
100 FLAG=0:A$=""
110 FOR A=0 TO (value)
120 B$=INKEY$:IF NOT B$="" AND
    FLAG=0 THEN A$=B$:FLAG=1
130 NEXT
```

The value of the first key depression is now stored in A$. If no key was pressed, then A$ will be empty.

INSTR: This statement is used to search one string to find out whether it contains a second string. The format is INSTR(main string, sub-string) where the starting position of the sub-string is returned on a successful match and 0 is returned if the search fails. INSTR("APC","C") would return 2 while INSTR("APC","X") would return 0.

We might, for example, want to find out whether NAME$ contains the sub-string 'Rev.'. Using INSTR, we would do this like so:

```
100 IF NOT(INSTR(NAME$,"Rev.")
    =0) THEN PRINT NAME$;" is a
    vicar."
```

To simulate this in standard Microsoft, we use MID$. In the above example, we would do so thus:

```
100 FLAG=0:FOR A=1 TO
    (LEN(NAME$)-4)
110 IF MID$(NAME$,A,4)="Rev."
    THEN FLAG=1
120 NEXT
130 IF FLAG=1 THEN PRINT
    NAME$;"is a priest."
```

Note that on an Atari, line 110 would read as follows:

```
110 IF NAME$(A,4)="Rev." THEN
    FLAG=1
```

and on a Sinclair machine, it would read:

```
110 IF NAME$(A TO A+4)="Rev."
    THEN FLAG=1
```

These differences are due to the non-standard forms of MID$ supported by these machines. The original example should work on all other dialects of Basic.

PROCEDURES AND FUNCTIONS: User-definable functions are supported in varying degrees of sophistication by a number of machines, but you are most likely to come across the extended use of procedures and functions in BBC programs. Procedures and functions make programs infinitely neater and more readable, but they don't actually achieve anything which cannot be duplicated using ordinary sub-routines.

Some dialects of Basic will allow you to GOTO or GOSUB a variable which greatly aids readability — the Basic Converter Chart will tell you which machines do if you look under GOTO.

Sharp Basic SP-5025 has a number of weaknesses which are discussed in the article 'Sharp Logic' in the September issue.

REPEAT-UNTIL and WHILE-WEND. These are two forms of the same control loop, one being the logical reverse of the other. WHILE-WEND checks that a given expression is true and then executes all statements up to the first WEND statement encountered. The computer then returns to the original condition to check whether it is still true. If the condition is false, the statement following the WEND statement is executed.

For example:

```
100 REM — Silly example
110 X=10
120 WHILE X>0
130 PRINT "The current value of X
    =";X;"."
140 X=X-1:WEND
150 REM - X is now zero and the WHILE
    test fails
```

In a WHILE-WEND loop, the loop is repeated while the test expression is true. A REPEAT-UNTIL loop works the other way around. All statements between REPEAT and UNTIL are executed until the test expression is true. Thus the above example would be written:

```
100 REM — Same silly example
110 X=10
120 REPEAT
130 PRINT "The current value of X
    =";X;"."
140 X=X-1:UNTIL X=0
150 REM - X is now zero and the
    REPEAT test is satisfied
```

Converting from one structure to the other is thus straightforward. But the majority of present-day Basics offer neither of the above. To create the same effect, we have to use a statement that causes purists to gasp in horror : the GOTO.

Thus:

```
100 REM — Here we go again
110 X=10
120 PRINT "The current value of X
    =";X;"."
130 IF X>0 THEN X=X-1:GOTO120
140 REM - X is now zero and the test fails
```

While somewhat less elegant, the net result is the same. We can see that rewriting a WHILE-WEND or REPEAT-UNTIL structure is simply a matter of manually inserting the test (using IF-THEN) and pointer (GOTO).

**STRING$** is a statement which allows you to repeat a given sequence of characters. The format is STRING$(number of times to print string,string). If you wanted to print a line of asterisks across an 80-column screen, for example, you would state: STRING$(80,"*"). If your machine doesn't support this statement, then we fall back once again on the ever ready FOR-NEXT loop. Thus: FOR A=1 TO 80:PRINT"*";:NEXT, the string is simply duplicated, and the numeric argument placed in the FOR-NEXT loop.

TAB. This is supported by most machines, except that on the BBC micro the TAB function is performed by SPC while TAB prints in predetermined screen fields.

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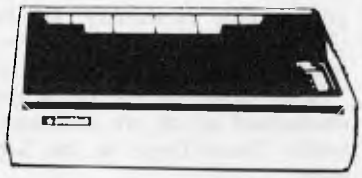

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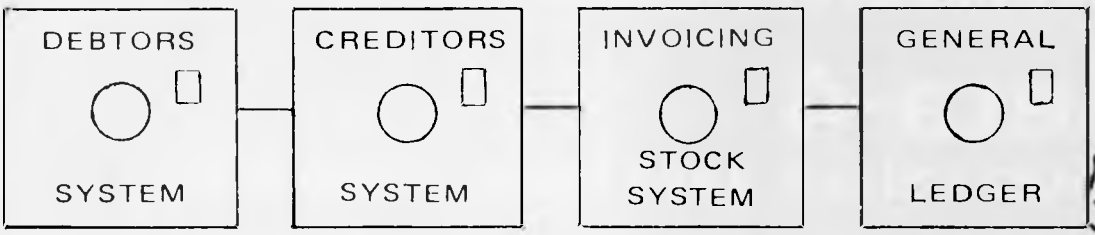

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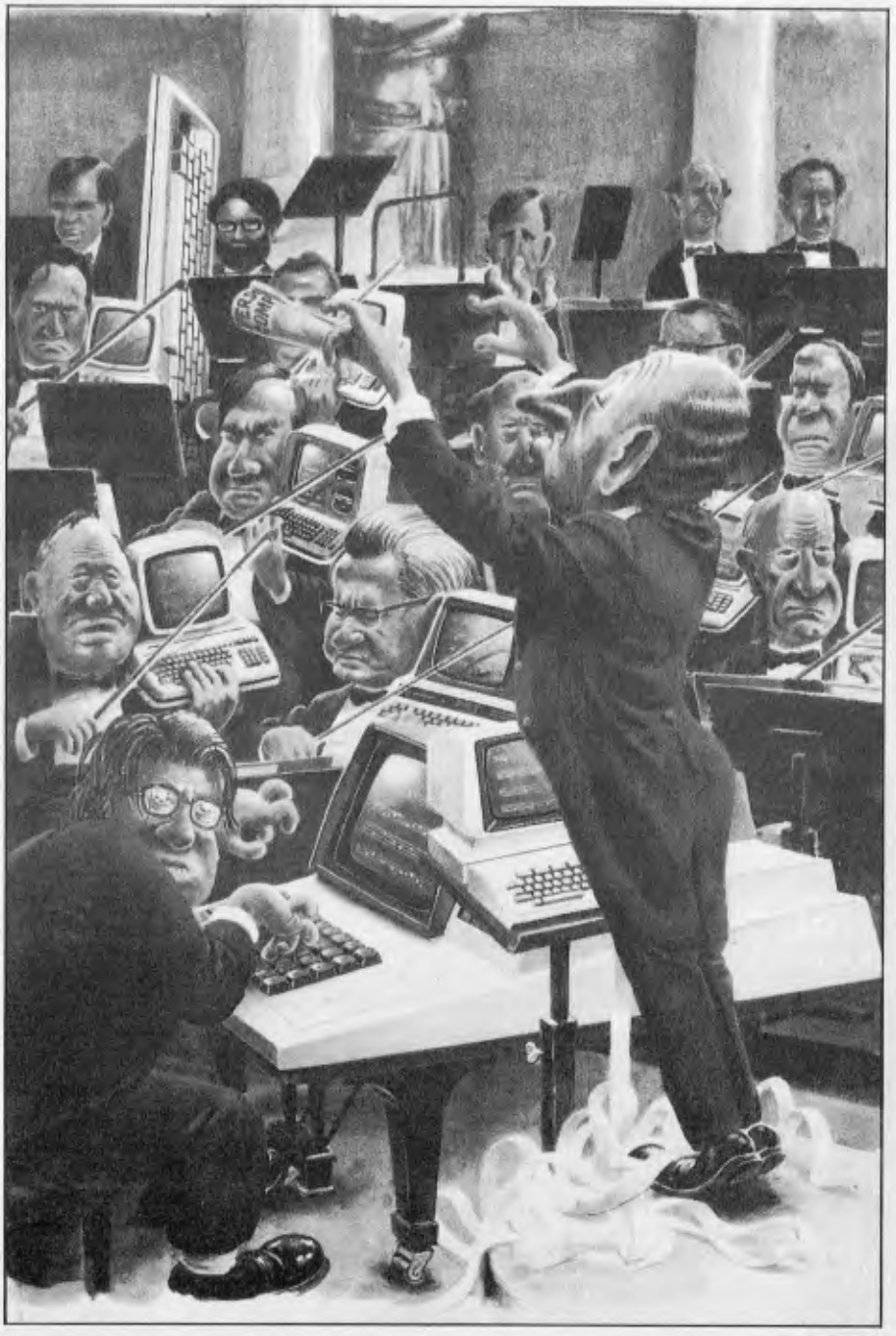
PART 2: DIGITAL SYNTHESIS

In the second of this three part series Simon Tait begins to set up a digital synthesis system on the BBC Micro. You'll have enough here to keep you working until the final part next month which completes the project.



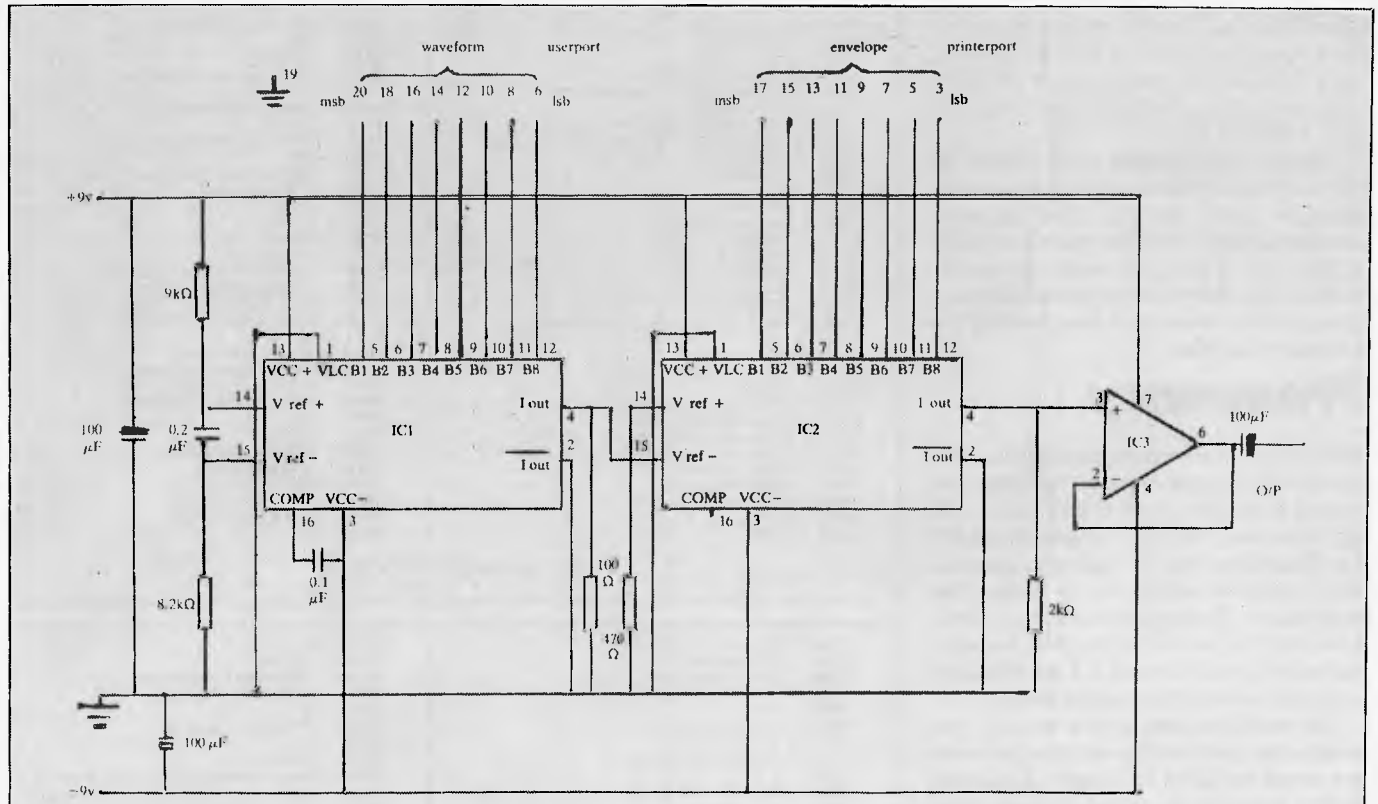
The system described in this article needs a BBC Model B Computer (with OS 1.2) and a digital to analogue (D to A) interface board. The D to A board consists of three chips (two DAC 08 type multiplying D to A convertors and a 741 operational amplifier) and can be built by anyone with a little experience. Probably the most expensive part of the hardware is the ribbon cable and two speedblock connectors which plug into the computer. Power supplies needed are +9v and −9v which can be simply provided by PP3 type batteries. The output of the board (mono) is connected to the Phono input of a hi-fi amplifier. The circuit diagram is shown in Fig 1.

Software for the system consists of three programs which run one after the other, two of which are described this month. The third will be published next month. The first program, 'DIGISYN' (Listing 1) programs the function keys with some of the commands needed to operate the system and sets the PAGE to make room for the machine code. The other program 'SYN.ASM' (Listing 2) assembles the machine code to output the samples to the D to A board. When it has finished it puts the address of the start of the code into the variable M%. The final program 'SYN. BAS' provides the user interface doing the calculations needed to produce the sounds specified, and will appear in Part 3.

How the system works

Hardware:

The hardware has the function of converting numbers fed to the computer user and printer ports to an analogue signal. The two ports are both provided in the computer by a single 6522 Versatile Interface Adaptor chip. This device is very sophisticated, and provides extra functions apart from simple input/output. None of these special functions are used by the machine code which outputs samples via this chip. Once the ports are configured



IC	Type
1	NE 5008 N
2	NE 5008 N standard DAC
3	7 4 1 08 type

Fig 1. Interface board circuit diagram

```
 10 REM********* Digisyn 0.3 ********
 20 REM (c) S.P.Tait 24th March 1983
100 *KEY0 TABLE|M
110 *KEY1 HARMONIC|M
120 *KEY2 SEGMENT|M
130 *KEY3 NEXT|M
140 *KEY4 LAST|M
150 *KEY5 INSERT|M
160 *KEY6 DELETE|M
170 *KEY7 PITCH|M
180 *KEY8 DURATION|M
190 *KEY9 PLAY|M
200 CLS
210 PRINT"          DIGISYN 0.3"
220 PRINT"          ----------"
230 PRINT"Please wait for Program to load"
240 PRINT"..."
250 PAGE=&E00+&200
300 CHAIN"SYN.ASM"
320 END
```

Listing 1: DIGISYN

```
  10 REM********* Digisyn 0.% ********
  20 REM (c) S.P.Tait 24th March 1983
 500 code%=PAGE-512:M%=code%
1000 mem%=&80
1010 soundoffset%=mem%
1020 tunePage%=1+mem%
1030 frequencyoffset%=2+mem%
1040 frequencyPage%=3+mem%
1050 envelopeoffset%=4+mem%
1055 envelopePage%=5+mem%
1060 controloffset%=6+mem%
1070 controlPage%=7+mem%
1080 Pitchoffset%=8+mem%
1090 Pitchfrac%=9+mem%
1100 duration%=10+mem%
1110 waveformoffset%=11+mem%
1120 waveformPage%=12+mem%
1130 waveformfrac%=13+mem%
1140 counter%=14+mem%
1150 Pitchfracstore%=15+mem%
1160 Pitchoffsetstore%=mem%+16
1200 via%=&FE60
1210 Portenvelope%=via%
1220 ddrb%=via%+2
5420   STAsoundoffset%
5430   LDAtunePage%
5440   CLC
5450   ADC&439
5460   STAtunePage%
5470   \main tune
5480   .repeatsound%
5490   \getinitial values
5500   LDY#0
5510   LDA(soundoffset%),Y
5520   CLC
5530   ADC&439
5540   STAfrequencyPage%
5550   INY
5560   LDA(soundoffset%),Y
5570   CLC
5580   ADC&439
5590   STAenvelopePage%
5600   INY
5610   LDA(soundoffset%),Y
5620   CLC
5630   ADC&439
5640   STAcontrolPage%
5650   INY
```

as simple outputs (lines 5220 to 5270 in 'SYN.ASM') the program can simply write numbers to the two ports as to any other memory locations in the computer.

Samples consisting of eight bit numbers or 'bytes' remain latched (stored) at the ports until they are rewritten by the computer. These eight bits appear at the connectors for printer and user ports in the form of eight pins, each of which can assume a voltage of 0v or 5v. The two sets of eight signals from the two connectors, together with other signals which are not used, pass down the ribbon cable to the interface board.

The two sets of signals arrive at their respective digital to analogue convertors. These convertors have the ability to multiply the quantity they are converting by a reference input. On the convertor board a constant reference is used for the first convertor and the output of this convertor provides the reference for the second convertor. In this way an analogue signal, which represents the value of the sample at the user port multiplied by the number at the printer ports, is produced.

Since the analogue signals, with which the convertors deal, are currents, and the final output needed is a voltage, a further component is needed in the circuit. A resistor is connected to the output of the second convertor to produce a voltage signal. An operational amplifier buffers the voltage to provide the final output.

Software:

The subroutine to output samples to the D to A board is written in machine code. Samples must be output at the rate of 50000

per second and so Basic would be far too slow. There are just 20 microseconds for the software to produce the next sample; the 6502 microprocessor used in the BBC computer may typically execute 13 instructions in this time.

Although the sample rate is stated as 50kHz, not every parameter of the sound is changed every sample. The program outputs samples from the waveform table at the full 50kHz, or every 20 microseconds, but the frequency and envelope is changed after about six milliseconds or 256 waveform samples.

Frequency

If the program were to output all 256 values in a waveform table one after the other, the period of the waveform would be 256 x 20 microseconds, giving a frequency of 195 Hz. To achieve lower or higher frequencies one possibility would be to change the sample rate. For a moderately high note, however, this would mean a time between samples of less than the 0.5 microsecond machine cycle of the microprocessor.

The method used in the system gets around the problem by skipping values in the waveform table for a higher frequency and by lingering on a value for more than one sample for a lower frequency. This happens quite naturally if the pointer used to point to the value in the waveform table has integer and fraction parts. The integer part points to the value in the waveform table and the fractional part is ignored except when the pointer is moved on. The amount to add to the pointer for a frequency F will be F/195.

This method does have an unfortunate side effect if the pointer falls between two values. The correct value will be neither one value nor the other but part way between the two. The software simply uses the integer part of the pointer and so always chooses the first of the two values. This means that the output will be slightly in error. The noise caused by this problem is sometimes noticeable when the waveforms have particularly strong harmonics.

In the program the pitch of the note is always stored as the pointer increment value mentioned. When the user specifies a pitch the value is converted and then stored. The pitch displayed is recalculated so this accurately represents the frequency that will be produced. The values in the frequency table are added to the increment value minus 128 to produce the final instantaneous increment.

```
1230 ddra%=via%+3
1240 acr%=via%+&B
1250 pcr%=via%+&C
1260 Portsound%=via%+&F
1300 tables%=&3000:?tunePage%=0
1310 noofParams%=6
1320 lastsound%=256/noofParams%-1
5000 REM*****MAIN MACHINE CODE*******
5010 FORoPt%=0 TO 3 STEP 3
5020   P%=code%
5200   [
5210   OPToPt%
5220   \set up VIA
5230   LDA#0
5240   STAPcr%
5250   LDA#&FF
5260   STAddra%
5270   STAddrb%
5280   \mask interrupts; set binary
5290   SEI
5300   CLD
5310   \zero offsets etc.
5320   LDA#0
5330   STAfrequencyoffset%
5340   STAenvelopeoffset%
5350   STAcontroloffset%
5360   STAwaveformoffset%
5370   STAwaveformfrac%
5380   STAPortsound%
5390   STAPortenvelope%
5400   \set up a tune
5410   LDA#0
5660   LDA(soundoffset%),Y
5662   SEC
5664   SBC#&80
5670   STApitchfracstore%
5680   INY
5690   LDA(soundoffset%),Y
5710   SBC#0
5720   STApitchoffsetstore%
5740   INY
5750   LDA(soundoffset%),Y
5760   STAduration%
5770   LDX#0
5780   LDY#0
5782   LDA#0
5784   STAcounter%
5790   LDA(frequencyoffset%),Y
5800   ADCpitchfracstore%
5810   STApitchfrac%
5812   LDApitchoffsetstore%
5814   ADC#0
5816   STApitchoffset%
5820   LDA(envelopeoffset%),Y
5830   STAportenvelope%
5840   LDA(controloffset%),Y
5842   CLC
5844   ADC&439
5850   STAwaveformPage%
5860   .repeatnote%
5870   NOP
5880   ]
5890   PROCmacrosample
5900   [
```

Listing 2: SYN.ASM

```
5910   OPToPt%
5920   DECcounter%
5930   BNErepeatnote%
5940   NOP
5950   NOP
5960   .repeatnote%
5970   ]
5980   PROCmacrosample
5990   [
6000   OPToPt%
6010   DECcounter%
6020   NOP
6030   BNErepeatnote%
6040   NOP
6050   ]
6060   PROCmacrosample
6070   [
6080   OPT oPt%
6090   NOP
6100   NOP
6110   NOP
6120   .repeatbrid9e%
6130   NOP
6140   NOP
6150   ]
6160   PROCmacrosample
6170   [
6180   OPToPt%
6190   LDAwaveformoffset%
6200   BPLrepeatbrid9e%
6210   NOP
6220   NOP
6230   NOP
6240   ]
6250   PROCmacrosample
6260   [
6270   OPToPt%
6280   NOP
6290   NOP
6300   NOP
6310   .repeatbrid9e2%
6320   NOP
6330   NOP
6340   ]
6350   PROCmacrosample
6360   [
6370   OPToPt%
6380   LDAwaveformoffset%
6390   BMIrepeatbrid9e2%
6395   INY
6400   LDA(controloffset%),Y
6410   CLC
6420   ADC&439
6430   STAwaveformPage%
6440   ]
6450   PROCmacrosample
6460   [
6470   OPToPt%
6480   ]
6500   PROCmacrosample
6510   [
6520   OPToPt%
6530   LDA(envelopeoffset%),Y
6540   STAPortenvelope%
6550   ]
6560   PROCmacrosample
6570   [
6580   OPToPt%
6590   LDA(frequencyoffset%),Y
6600   ADCpitchfracstore%
6610   STApitchfrac%
6611   PHP
6612   ]
6613   PROCmacrosample
6614   [
6615   OPToPt%
6616   PLP
6617   LDApitchoffsetstore%
6618   ADC#0
6619   STApitchoffset%
6620   ]
6630   PROCmacrosample
6640   [
6650   OPToPt%
6670   CPYduration%
6680   BEQcontinue%
6685   JMPrepeatnote%
6687   .continue%
6690   LDAsoundoffset%
6692   CLC
6694   ADC#noofParams%
6700   STAsoundoffset%
6710   CMP#(lastsound%+1)*noofParams%
6720   BEQdone%
6730   LDA(soundoffset%,X)
6740   CMP#0
6750   BEQdone%
6760   JMPrepeatsound%
6770   .done%
6775   CLI
6780   RTS
6790   ]
6800   NEXToPt%
6805 CHAIN"SYN.BAS"
6810 END
10000 REM*****MACHINE CODE SUPPORT*****
10010 DEFPROCmacrosample
10020 [
10030 OPToPt%
10040 LDA(waveformoffset%,X)
10050 STAPortsound%
10060 LDAwaveformfrac%
10070 ADCpitchfrac%
10080 STAwaveformfrac%
10090 LDAwaveformoffset%
10100 ADCpitchoffset%
10110 STAwaveformoffset%
10120 ]
10130 ENDPROC
```

Machine code

Whatever tasks are going on while a note is sounding, the rate of sampling must not change. Every 40 machine cycles (20 microseconds) a sample must be output and the waveform pointer updated. This would seem to be an ideal candidate for a subroutine except that calling a subroutine takes 10 of the 40 cycles available. The code to output and update must therefore be written 'in-line' wherever it crops up.

To simplify matters this group of instructions is defined as a 'macro'. This means that a Basic procedure is written which will assemble this group of instructions whenever needed (lines 10000 to 10130 in SYN.ASM). After the sample is changed we have 13 cycles left before we must output the next sample.

NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in APC. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. Well, in the words of *The Hitch-hikers' Guide to the Galaxy*, don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which the computer's output is displayed'. This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *APC*.

For those completely new to computing, let's start with the question: what is a microcomputer? We can think of a micro as a general-purpose device as opposed to a typewriter which can only be used for typing, a calculator to perform calculations, a filing-cabinet to file information and so on. A micro can do all those things and more.

If it is to be of any use, a general-purpose device needs some way of having a function assigned to it. We do this by giving the computer a set of logical instructions called a **program**. The general term for computer programs is **software**. Every other part of a microcomputer system is known as **hardware**. 'If you can touch it, it's hardware.'

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a code known as a **computer language**. There are literally hundreds of different languages around, the most popular of these being **Basic**. Basic is an acronym of **B**eginners' **A**ll-purpose **S**ymbolic **I**nstruction **C**ode. Although originally intended only as a simple introductory language, Basic is now a powerful and widely-used language in its own right.

Other languages you're likely to come across in *APC* include **Forth, Pascal, C** and **Comal**. These are known as **high-level** languages because they approach the sophistication of a human language. You'll also see references to the **low-level** languages, **assembly language** and **machine code**. We'll look at high and low-level languages in a moment.

The heart of a micro, the workhorse, is the **processor** or **Central Processing Unit (CPU)**. The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor around, the Z80, 6502 and 8088 being the three most common. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.

Being electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by **binary** (base two) notation, the two binary digits (known as **'bits'**) being 0 and 1. It is possible to program computers in binary notation, otherwise known as **machine code** (or machine language) programming.

Machine code is called a low-level language because it operates at a level close to that 'understood' by the processor. (Languages like Basic are known as high-level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.)

Between high-level languages and machine code is a low-level language known as **assembly language** or, colloquially, **assembler**. This is a mnemonic code using symbols which the processor can quickly convert to machine code.

Since there is no binary equivalent of a comma or the letter 'a', for example, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the American Standard Code for Information Interchange, **ASCII**. This system assigns each character a deeimal number which the processor can then convert to its binary equivalent.

There are two types of program to do this translation for us. The first of these is a **compiler** which translates our whole program permanently into machine code. When we compile a program, the original high-level language version is called the **source code** while the compiled copy is called the **object code**. Compiled programs are fast to run but hard to edit. (If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code.) For this reason there is a second translation program: an **interpreter**. An interpreter waits until we aetually run (use) the program, then translates one line at a time into machine code — leaving the program in its original high-level language. This makes it slower to run than a compiled program, but easier to edit.

There are two strange-sounding Basic words you're likely to come across: **POKE** and **PEEK**. When you program in a high-level language, you are normally unable to choose which part of the machine's memory the processor will use to store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'POKE' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above POKE with 'PEEK 10000', the computer would respond by displaying the value 56. (POKEing and PEEKing is normally done to increase program speed. It's a compromise between Basic and machine code.)

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of memory. There are two types of memory known as **R**ead **O**nly **M**emory **(ROM)** and the badly-named **R**andom **A**ccess **M**emory **(RAM)**. ROM is so-called because the processor can **'read'** (get things out of) its contents, but is unable to **'write** to' (put things in) it.

ROM is used to store firmware, which consists of software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and data (information). The second important difference is that RAM needs a constant power-supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8-bit binary number. 8 bits make one byte and 1024 bytes make one **kilobyte** or **1k**. 32k, for example means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 ... 1024 being the nearest binary multiple to 1000.

There are numerous forms of **permanent** or **backup** storage, but by far the most common are the **floppy disk** and **cassette**.

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a **disk drive**. Disk drives comprise a high-speed motor to rotate the disk and a read/write head to record and 'playback' programs and data.

The disk is divided into concentric rings called **tracks** (similar to the tracks on an LP) which are in turn divided into small blocks by spoke-like divisions called **sectors**.

There are two methods for dividing the disk into sectors. One method is called **hard-sectoring**, where holes punched in the disk mark the sectors, and the other is **soft-sectoring** where the sectors are marked magnetically. (The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers do seem to have begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible with each others.')

Since the computer needs some way of tracking the whereabouts of everything on the disk, we have a program called a **Disk Operating System**, more usually known simply as the **Operating System (DOS** or **OS)**. The operating system does all the 'house-keeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available (each with its own advantages and disadvantages). The two most popular OSs are **CP/M** (Control Program for Micros) and **MS-DOS** (MicroSoft Disk Operating System).

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and is adequate for games and the like.

Another type of disk you'll see referred to is the **hard disk**. This is an extremely efficient method of storing large amounts of programs and data. Hard disk capacity generally starts at around 10 **Mbytes** (10 million bytes) and rises to ... well, you name it. Besides offering a mueh greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Since computers need some way of communicating with the outside world, we need input and output devices. Input and output devices include all manner of things from hard disk units to light-pens, but the minimum requirement for most applications is a typewriter-style **keyboard** for input and a tv-like **Visual Display Unit** for output. The Visual Display Unit is variously referred to as a **VDU, Cathode Ray Tube (CRT)** and **monitor**.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, etc) may all be built in to a single unit or they may be separate, connected by cables.

Take this paragraph slowly and it makes sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — **parallel** or **serial**. **Parallel input/output (I/O)** requires a number of parallel wires. Each wire carries one bit, so with 8 wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). **Serial I/O**, in contrast, uses a single wire to transmit a series of bits one at a time with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different **interfaces**. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the **RS232** (or **V24**) while the **Centronics** standard is popular for parallel interfaces.

When two computers want to communicate with each other over a distance, there are again two ways of doing it. Both methods use the public phone network. The simplest and cheapest method is to use a device known as an **acoustic coupler**. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. However an acoustic coupler is slow and not exceptionally reliable.

A more sophisticated (and correspondingly more expensive) method is to use a **modem**. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from Telecom.

So, now you know!

BANKS' STATEMENT

SPREAD THE WORD

Martin Banks speculates on the dangers of talking computers in education: will the parents opt out and let the children communicate in monotones?

Whence upon a time, somewhere out there in the dim and distant future, a small child will come up to its parent-person (all sexist expressions and denominations having been expunged from the language) and say: 'Deah pah rent per san, ma eyeee havva ba nan aaaaH?'

To this, the parent-person will look askance at the small child and say 'eh?'.

The time will have at last dawned when there is no longer any common ground for normal, verbal communications between what constitutes the old and *passé* (typified by said parent-persons the world over) and the new, dynamic and trendy. Small persons will be talking a strange kind of monotonic, monosyllabic anguish (sorry, English) that us older mortals — trained as we were in verbal interaction with someone who spoke something approaching something understandable by every one else — will be unable to comprehend.

'. . . there could be children who speak a fractured kind of English learned at the knee of a talking computer . . .'

These small persons will have acquired this strange language not from school, where most of us picked up at least the more 'fundamental' aspects of our communicative capabilities, but from little plastic boxes of various sizes and colours. These boxes will by that time have become to these small persons surrogate parent-persons to whom they will look for all sorts of necessary and unnecessary help and advice.

The boxes, as if you didn't know, are all these 'talking' computers, machines which, through a variety of techniques, synthesise the human voice and speak words that can be understood.

Speech synthesis is, in my 'umble opinion, one of the best things to come out of the application of new technology. It is, however, also one of the worst. Now I know this may look like another classic case of Banksey facing in two directions at once, but I feel I can justify such Beeblebroxianism.

It is one of the greatest things (speech synthesis, I mean) because it can be used in a variety of extremely important ways that are of great benefit to personkind. For example, there are a large number of applications in boring things like industry where the capability of a computer control system to enunciate clearly and, perhaps more important, rapidly a problem, danger or similar area of concern to a human operative can prove to be no less than a life saver. There are applications where the use of speech as an instructional tool to humans can be beneficial. The list is endless.

One entry on this list will be education. Indeed, it has to be on the list for it has already become one of the most popular applications of speech technology. It is here that my Beeblebroxianism starts coming into play, for I really do have my doubts about some of this.

At face value, the use of speaking boxes for education has a great deal of merit. Because they are driven by computers, which are themselves morons, they can be instructed to take a child methodically

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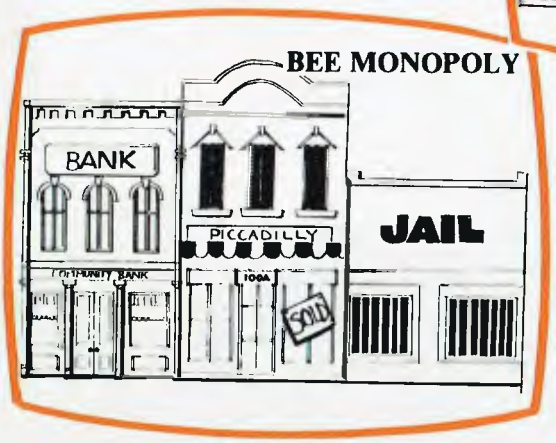

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For those who enjoy a serious graphics game it is hard to beat Chess. If your game needs improving try the tutorial first. You can select from 6 levels of play and these can be altered during the game. This program features very good graphics and, particularly at the higher play levels, becomes a most worthy opponent. (32k **microbee** recommended).
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TARGET/TREK
These are two of the 'classics' of computer games and will still impress with the use of characters to emulate graphics (remember they only had teletypes on the 'old' days around 1976). The challenge of Trek will attract even the most ardent 'anti games freaks'.
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QLD: **Software 80,** 105 Milton Road, Milton.

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through its learning paces in a way (subject to programming, of course) that can be fun, inspirational and rewarding. Dammit, the kids seem to like being taught by these things.

This is all well and good, up to a point. My problem is that I wonder just where that point ought to be. The reason I feel that there is a problem at all stems from the fact that if these boxes are so popular with the kids, and if they do, as they seem to do, a reasonable job in educating children in the fundamentals of arithmetic, grammar, sentence construction and the like, there will be a strong temptation for parent-persons to opt out. This will be either from choice (more time to spend doing the washing, mending the car, doing the pools, going down the pub, etc) or from rejection by the kids because the parent-persons were more boring than the machines, anyway.

Whatever the reason, such a trend is both sad and potentially harmful. It is noticeable, for example, how most parents will at some time refer to the way their children have changed since going to school. The 'pernicious' influence of teachers and other children markedly alters the horizons and perspectives of their 'one-and-only', and often that alteration is permanent.

Exactly the same effects can be achieved with more automated teaching environments, and the effect can be that much greater because the 'environment' can be brought home and set up in a bedroom or living room. These teaching machines carry with them an onerous responsibility on both the parents who buy them and (hopefully) oversee their utilisation, and on the manufacturers and programmers who constructed the machines in the first place.

The responsibility on the parents is that they do not succumb to the temptations that such teaching machines present. It would be very easy indeed to buy a specialised teaching system or concentrate of education software for a general purpose home computer, and assume that the best was being done by the children.

It would become an easy matter to restrict the overseeing of children to the level of ensuring that they were not wasting time playing Space Invaders, and taking no further interest beyond that point. It would be a very tempting prospect; many parents are already happy enough to opt out of a fair proportion of their responsibilities given half a chance. Human nature is, after all, human nature.

Now, it is difficult for most people to query the educational content of the material that children are thus given. At the simplest levels of education (2+2=4, etc) there often seem to be as many theories on how best to present the material as there are educationalists working in the field. At the higher levels, many parents probably wouldn't know the answers any better than the kids, so could not value-judge the efficacy of the education.

This holds true for all forms of education, be it in school with human-type teachers or at home with a computer or education machine. With some of the education machines, however, there are areas that could and should be overseen by the parents, especially where the machines use pseudo-human techniques of interaction.

As such machines go at present, extremely clever though they are to the completed adult, they fall far short of what we should be wanting for our children. The voices that emanate from these boxes are, to date, serious emasculations of what passes for the English language.

Technology is going to be used increasingly to create ever-more powerful and comprehensive educational systems. This in turn is going to give more parent-persons the opportunity to opt out of the responsibility (to use an old-fashioned word) of participating in their off-spring's education. If such opting out ever proves at some future date to have been a great mistake its discovery, as happens with all the best mistakes, will be too late. END

APC SUBSET

Alan Tootill and David Barrow present more useful assembler language subroutines. This is your chance to build a library of general-purpose routines, documented to the standard we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. APC will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET, 77 Glenhuntly Road, Elwood, Vic 3184.

6502 user stack

Inspired by the 6809 instruction set, Martin Ford has submitted four Datasheets to implement some of its most useful features on the 6502 processor. We give here two of them, PSH16 and PLL16, which provide for a user stack at a 16-bit address anywhere in memory to hold any combination of eight registers, as determined by the bit setting of a byte embedded in the code, immediately following the jump to the subroutines to push and pull the registers. The registers that can be saved on the stack are PC, P, A, X, Y and six contiguous zero page locations (taken as three two-byte registers, M5-M4, M3-M2 and M1-M0).

The program counter, if pushed onto the user stack, has been incremented to point to the parameter byte (instead of the last byte of the jump instruction). The PC then being pulled from the user stack causes program execution from the stacked address + 1 on return from PLL16. This is a facility that needs to be used with some care.

DATASHEET

```
;* PSH16 - Push to 16-bit addressed user stack.
;/ CLASS: 1
;/ TIME CRITICAL?  No.
;/ DESCRIPTION:  Pushes registers and zero page onto a 16-bit
;/               user stack according to a parameter byte in
;/               the code following the JSR instruction:
;/               Bit set      Register pushed
;/                  0              M0,M1
;/                  1              M2,M3
;/                  2              M4,M5
;/                  3                Y
;/                  4                X
;/                  5              ACC
;/                  6                P
;/                  7               PC
;/ ACTION:  All the registers including the zero page are pushed
;/          onto the 6502 hardware stack.  Get byte at return address
;/          Repeat:
;/            Shift parameter byte left.
;/            If carry set get byte off stack and put onto user
;/            stack.  Point to next space on user stack.  If it was
;/            a 2-byte register do the same for the next byte on
;/            the stack.  If 2-byte register point to the next.
;/          8 times.
;/          Put updated address of user stack into pointer (ZP).
;/          Restore all registers and return to the incremented
;/          return address.
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  RAM used for user stack.
;/ INPUT:  2 zero page bytes, ZP-ZP+1, point to the user stack + 1
;/         and a pseudo-oprode at the return address gives the
;/         registers to be pushed as described above.
;/ OUTPUT:  ZP,ZP+1 point to the last byte saved on the stack.
;/ REGs USED:  None.
;/ STACK USE:  10
;/ LENGTH:  107
;/ PROCESSOR: 6502

   PSH16   PHP             ;put all                        08
           PHA             ;registers                      48
           TXA             ;including                      8A
           PHA             ;M0 - M5                        48
           TYA             ;onto                           98
           PHA             ;6502                           48
           TSX             ;stack.                         BA
           LDY  #$06       ;count in Y.                    A0 06
   PUSH1:  LDA  M0-1,Y     ;get zero page locations        B9 ZZ 00
           PHA             ;and save                       48
           DEY             ;all six                        88
           BNE  PUSH1      ;on the stack.                  D0 F9
           INC  $105,X     ;return address                 FE 05 01
           LDA  $105,X     ;return address + 1,            BD 05 01
           STA  M0         ;which is                       85 ZZ
           BNE  PUSH2      ;placed                         D0 03
           INC  $106,X     ;M0,M1.                         FE 06 01
   PUSH2:  LDA  $106,X     ;                               BD 06 01
           STA  M1         ;                               85 ZZ
           LDA  #$87       ;register size code             A9 87
           STA  M2         ;byte to M2.                    85 ZZ
           LDA  (M0),Y     ;get parameter byte             B1 ZZ
           STA  M3         ;in M3.                         85 ZZ
           LDA  #$08       ;byte bit count                 A9 08
           STA  M4         ;to M4.                         85 ZZ
           DEY             ;Y = 255. (ZP),Y points to      88
           DEC  ZP+1       ;next space on user stack.      C6 ZZ
   PUSH3:  ROL  M3         ;see if parameter               26 ZZ
           BCC  PUSH4      ;byte bit set.                  90 10
           LDA  $106,X     ;if so, out first               BD 06 01
           STA  (ZP),Y     ;byte on user stack.            91 ZZ
           DEY             ;point to next space.           88
           BIT  M2         ;is it a 2-byte register?       24 ZZ
           BPL  PUSH4      ;if so, put next                10 06
           LDA  $105,X     ;byte off 6502                  BD 05 01
           STA  (ZP),Y     ;stack to user                  91 ZZ
           DEY             ;stack.                         88
   PUSH4:  DEX             ;                               CA
           ROL  M2         ;                               26 ZZ
           BCC  PUSH5      ;for a 2-byte                   90 01
           DEX             ;register X = X-2.              CA
   PUSH5:  DEC  M4         ;do eight                       C6 ZZ
           BNE  PUSH3      ;times.                         D0 E2
           SEC             ;calculate new                  38
           TYA             ;user stack pointer             98
           ADC  ZP         ;according to number            65 ZZ
           STA  ZP         ;of bytes pushed                85 ZZ
           BCC  PUSH6      ;and return it                  90 02
           INC  ZP+1       ;to ZP,ZP+1.                    E6 ZZ
   PUSH6:  LDY  #0         ;replace all                    A0 00
   PUSH7:  PLA             ;zero page to                   68
           STA  M0,Y       ;clear up stack.                99 ZZ 00
           INY             ;                               C8
           CPY  #$06       ;                               C0 06
           BNE  PUSH7      ;                               D0 F7
           PLA             ;replace registers.             68
           TAY             ;                               A8
           PLA             ;                               68
           TAX             ;                               AA
           PLA             ;                               68
           PLP             ;                               28
           RTS             ;and return.                    60
```

DATASHEET

```
;* PLL16 - Pulls from 16-bit addressed user stack.
;/ CLASS: 1
;/ TIME CRITICAL?  No
;/ DESCRIPTION:  Pulls registers and zero page off a user stack
;/               according to a parameter byte in the code
;/               following the JSR instruction:
;/               Bit set    Register pulled
;/                  0              M0,M1
;/                  1              M2,M3
;/                  2              M4,M5
;/                  3                Y
;/                  4                X
;/                  5              ACC
;/                  6                P
;/                  7               PC
```

```
;/ ACTION:  Push all registers, including zero page, onto the
;/          6502 stack.  Get parameter byte at the return address.
;/          Repeat:
;/             Shift parameter byte left.
;/             If carry set get byte off user stack onto 6502 stack.
;/             Point to next space on stack.  If it was a 2-byte
;/             register, do the same for the next user stack byte.
;/          8 times.
;/          Put new address of user stack into ZP.
;/          Restore all registers and return to the incremented
;/          return address.  RTS completes the pulling of PC, if saved.
;/ SUBr DEPENDENCES:  None.
;/ INTERFACES:  RAM used for user stack.
;/ INPUT:  2 zero page bytes.  ZP,ZP+1, points to the first byte
;/         to be pulled from the user stack and a pseudo opcode
;/         at the return address gives the registers to be pulled.
;/ OUTPUT:  ZP,ZP+1 point to the last byte + 1 to be pulled.
;/ REGS USED:  Those registers and zero page pulled from the user stack.
;/ STACK USE:  10
;/ LENGTH:  104
;/ PROCESSOR:  6502.

PULL6:  PHP             ;put all                        08
        PHA             ;registers                      48
        TXA             ;including                      8A
        PHA             ;M0 - M5                        48
        TYA             ;onto the                       98
        PHA             ;6502 stack.                    48
        LDX  #$06       ;count in Y.                    A0 06
PULL7:  LDX  M0-1,Y     ;get zero page locations        B9 ZZ 00
        PHA             ;and save                       48
        DEY             ;all but M0                     88
        BNE  PULL7      ;on the stack.                  D0 F9
        TSX             ;                               BA
        INC  $108,X     ;return address +               FE 08 01
        LDA  $108,X     ;return address + 1,            BD 08 01
        STA  M0         ;which is                       85 ZZ
        BNE  PULL2      ;plated in                      D0 03
        INC  $10C,X     ;M0,M1.                         FE 0C 01
PULL2:  LDA  $10C,X     ;                               BD 0C 01
        STA  M1         ;                               85 ZZ
        LDA  #$E1       ;register size code             A9 E1
        STA  M2         ;byte to M2.                    85 ZZ
        LDA  (M0),Y     ;get parameter byte             B1 ZZ
        STA  M0         ;in M0.                         85 ZZ
        LDA  #$08       ;byte bit count                 A9 08
        STA  M1         ;to M1.                         85 ZZ
PULL3:  ROR  M0         ;save if parameter              66 ZZ
        BCC  PULL4      ;bit to be set.                 90 10
        LDA  (ZP),Y     ;If so, move user               B1 ZZ
        STA  $101,X     ;stack byte to 6502 stack.      9D 01 01
        INY             ;point to next byte.            C8
        BIT  M2         ;Is it a 2-byte register?       24 ZZ
        BPL  PULL4      ;If so, get next                10 06
        LDA  (ZP),Y     ;byte into 6502                 B1 ZZ
        STA  $102,X     ;stack from                     9D 02 01
        INY             ;user stack.                    C8
PULL4:  INX             ;                               E8
        ROL  M2         ;                               26 ZZ
        BCC  PULL5      ;for a double register          90 01
        INX             ;8 + x+1                        E8
PULL5:  DEC  M1         ;do eight                       C6 ZZ
        BNE  PULL3      ;times.                         D0 E2
        CLC             ;Calculate new                  18
        TYA             ;user stack pointer             98
        ADC  ZP         ;according to number            65 ZZ
        TAY             ;of bytes pulled                85 ZZ
        BCC  PULL6      ;and return it                  90 02
        INC  ZP+1       ;to ZP,ZP+1.                    E6 ZZ
PULL6:  LDX  #0         ;replace all                    A0 00
PULL7:  PLA             ;zero page to                   68
        STA  M0,Y       ;clear up stack.                99 ZZ 00
        INY             ;                               C8
        CPY  #6         ;                               C0 06
        BNE  PULL7      ;                               D0 F7
        PLA             ;replace registers              68
        TAY             ;and return                     A8
        PLA             ;first PC                       68
        TAX             ;pulled                         AA
        PLA             ;the return                     68
        PLP             ;in to the                      28
        RTS             ;new address).                  60
```

Computer dating

If you remember the routines CVDAYS (date to days conversion) and CVDATE (days to date) printed in last April's Sub Set, you may also remember that their author, Andrew Bain, wanted to see shorter and faster versions. This request spurred C Duffin into sending improvements to both routines.

Cormac's CVDAYS is actually one byte longer than the original but uses multiplication by shifting where the original used repeated addition. This results in a time saving when the year's number is greater than ten. His CVDATE, however, is 17 bytes shorter and about 45% faster.

Like Andrew's original versions, the routines address a 12 byte table of the number of days in each calendar month. Unlike the original, they change February's value to take account of leap years.

Base day 1 must be 1 January of the year following a leap year. 1 January, 1901 is a logical choice for this base day as dates can then be input 'straight' (in binary, of course) to give the elapsed days since 31 December, 1900.

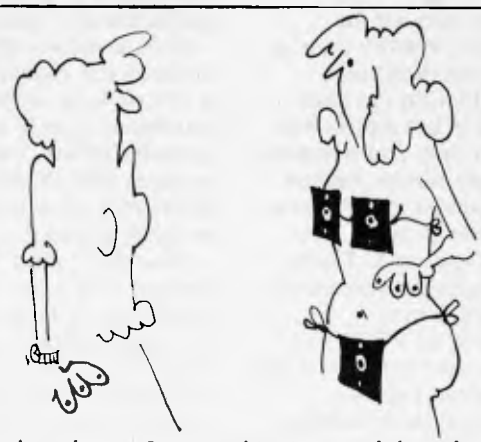
DATASHEET

```
;/ CVDAYS - Convert day/month/year to days since 01/01/0'
;/ CLASS:  2 (directly addresses table in RAM)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Converts a date expressed numerically as
;/               day/month/year to count of days from (and
;/               including) day 1 (expressed as 01/01/01).
;/               Day 1 must be 1st January of a year following
;/               a leap year.  Accurate for years 1 to 179
;/               after base day but not if a century year not
;/               divisible by 400 is within that range.
;/ ACTION:  BC ← days + completed lead year days + day length
;/          of each completed month + 365 * completed years.
;/ SUBR DEPENDENCES:  None
;/ INTERFACES:  Month-length table (MONTAB) in RAM.
;/ INPUT:  day (1 to 31) in A, month (1 to 12) in B,
;/         year (1 to 179) in C.  All values in binary.
;/ OUTPUT:  BC = no. of days since (and including) 1st January
;/          year 1.
;/ REGS USED:  AF BC
;/ STACK USE:  4
;/ LENGTH:  38 (+ 12 for month-length table)
;/ TIME STATES:  A reasoned average value is 850.
;/ PROCESSOR:  Z80

CVDAYS:  PUSH  HL       ;save registers.                E5
         PUSH  DE       ;                               D5
         LD    L,0      ;HL = days                      26 00
         LD    L,A      ;                               6F
         LD    DE,MONTAB-1 ;index month-length table at  11 xx xx
         LD    A,C      ;(February).  Get month number  79
         AND   03H      ;and test for a leap year.      E6 03
         LD    A,1CH    ;Setting February to 28 but     3E 1C
         JR    NZ,NOTLPY ;29 if a leap year.           20 01
         INC   A        ;                               3C
NOTLPY:  LD    (DE),A   ;                               12
         DEC   DE       ;then index table start.        1B
         DEC   C        ;using completed years,         0D
         LD    A,C      ;calculate number of            79
         RRA            ;leap years                     1F
         RRA            ;then add into HL               1F
         AND   3FH      ;as extra                       E6 3F
         ADD   A,L      ;leap days.                     85
         LD    L,A      ;                               6F
         DEC   B        ;count of completed months.     05
         JR    Z,CYRS   ;skip if month is January.      28 0A
DYMNTH:  LD    A,(DE)   ;else add into loop adding      1A
         INC   DE       ;stated month lengths for       13
         ADD   A,L      ;all completed months           85
         LD    L,A      ;into HL.                       6F
         JR    NC,DYMTST ;                              30 01
         INC   H        ;add any carry to hi-byte.      24
DYMTST:  DJNZ  DYMNTH   ;                               10 F7
CYRS:    AND   A        ;Clear Cy for multiplication and A7
         LD    A,C      ;test. Multiply completed years 79
```

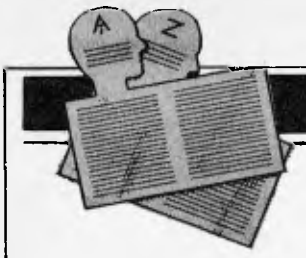
```
                LD      DE,16DH         ;by 365:                        11 6D 01
DYYRS:          RRA                     ;shift out to Cy next place bit 1F
                JR      NC,NXTPLC       ;of years and if set            30 01
                ADD     HL,DE           ;add 365 * place.               19
NXTPLC:         EX      DE,HL           ;shift 365 up one bit to        EB
                ADD     HL,HL           ;correct next place for         29
                EX      DE,HL           ;next place of year.            EB
                OR      A               ;repeat for each place set bit. B7
                JR      NZ,DYYRS        ;                               20 F4
                LD      B,H             ;total elapsed days into        44
                LD      C,L             ;BC for exit.                   4D
                POP     DE              ;restore registers              D1
                POP     HL              ;                               E1
                RET                     ;and return.                    C9
;table of month lengths
MONTAB:         DEFB    1FH,00H         ;Jan=31, Feb fixed by routines  1F 00
                DEFB    1FH,1EH         ;Mar=31, Apr=30                 1F 1E
                DEFB    1FH,1EH         ;May=31, Jun=30                 1F 1E
                DEFB    1FH,1FH         ;Jul=31, Aug=31                 1F 1F
                DEFB    1EH,1FH         ;Sep=30, Oct=31                 1E 1F
                DEFB    1EH,1FH         ;Nov=30, Dec=31                 1E 1F
```

DATASHEET

```
;* CVDATE = Convert days since 01/01/01 to day/month/year
;/ CLASS:  2 (directly addresses table in RAM)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Converts a date expressed as the number of
;/               elapsed days since day 1 to a day/month/year
;/               format.
;/ ACTION: Repeatedly subtracts 365 until the subtraction
;/         won't go to determine years.  Fixes February in
;/         month-length table to 28 or 29 if leap year.
;/         Subtracts month lengths in turn from table until
;/         subtraction won't go to determine months.  Remainder
;/         gives days.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES: Month-length table (MONTAB) in RAM.
;/ INPUT:  BC = no. of days since (and including) 1st
;/         January year 1.
;/ OUTPUT:  A = day, B = month, C = year.
;/ REGS USED:  AF BC
;/ STACK USE:  6
;/ LENGTH:  50 (+ 12 for month-length table)
;/ TIME STATES:  Average approximately 510 + 35 * years
;/ PROCESSOR:  Z80

CVDATE:  PUSH   HL              ;save registers.                E5
         PUSH   DE              ;                               D5
         LD     H,B             ;elapsed days into HL for       60
         LD     L,C             ;arithmetic.  Change count from 69
         DEC    HL              ;'from 1' to 'from 0'.          2B
         LD     DE,16DH         ;divisor of days-in-a-year.     11 6D 01
         LD     BC,+0           ;clear month/year regs.         01 00 00
         LD     A,88H           ;leap year Carry-setter.        3E 88
DIYRS:   INC    C               ;repeatedly subtract divisor,   0C
         RRCA                   ;with carry every leap year,    0F
         SBC    HL,DE           ;counting years in( until       ED 52
         JR     NC,DIYRS        ;not a full year left.          30 FA
         PUSH   BC              ;then save year count, get last C5
         RLCA                   ;(leap year?) carry and get back 07
         ADC    HL,DE           ;positive remainder.            ED 5A
         LD     DE,MONTAB+1     ;index month-length table at Feb. 11 XX XX
         RRCA                   ;get (leap year?) carry again   0F
         LD     A,B             ;and make Feb. 28 or 29         78
         ADC    A,1CH           ;if a leap year.                CE 1C
         LD     (DE),A          ;                               12
         DEC    DE              ;then index table start.  Clear 1B
         XOR    A               ;month count (A) and Carry.     AF
DIMNTH:  INC    A               ;Loop, subtracting tabled month 3C
         EX     DE,HL           ;lengths and counting months    EB
         LD     C,(HL)          ;until not a full month left.   4E
         INC    HL              ;                               23
         EX     DE,HL           ;                               EB
         SBC    HL,BC           ;                               ED 42
         JR     NC,DIMNTH       ;                               30 F7
         ADD    HL,BC           ;get positive remainder (days)  09
         POP    BC              ;in HL. Restore years in C.     C1
         LD     B,A             ;move months to B, and days from 47
         LD     A,L             ;L to A, correcting for initial 7D
         INC    A               ;DEC HL which eliminated tests  3C
         POP    DE              ;for zero result in subtractions. D1
         POP    HL              ;restore registers              E1
         RET                    ;and return.                    C9
;table of month lengths (MONTAB) same as CVDAYS.
```

'It's the only way I can get him interested these days.'



USER GROUPS INDEX

DIRECT ACCESS

Below is a complete list of user groups known to us in Australia and New Zealand. User Groups' Secretaries are asked to provide us with alterations, additions and corrections as promptly as possible to avoid a longer than necessary delay before publication. During the next few months, these changes will be published and the next complete listing will appear in the May 1984 issue of APC.

NEW SOUTH WALES

SORCERER USERS GROUP

At the October meeting, a successful on-line trial demonstration was given of the group's new Remote Bulletin Board System. Some hardware is still on order, and the demonstration used some borrowed equipment. However, opening day isn't far away.

Another development has been the merger of the group's program library with that of "Sorcerer Computers Users of Australia" in Melbourne. The joint library is now being run from Sydney, and members of both groups may place orders by writing to SUG, Box E162, St James 2000.

The monthly meeting is held on the third Friday, 8.00pm, at the Greenwich Community Hall, Greenwich Road, Greenwich N.S.W.

MEGS

MEGS has moved from its original meetings at the WIA Hall at St Leonards following sale of the building. MEGS now meets in the hall at the rear of St Andrew's Presbyterian Church, 37 Anderson Street, Chatswood, on the third Monday of each month commencing at 7pm. All old members, and prospective members are encouraged to come along. Club membership fees have been held at the 1977 level of $15 per year.

MEGS also has a new mailing address at P.O. Box 1309, Chatswood NSW 2067.

Further information may be obtained by phoning the Publicity Officer Jim Hooke on 419 2568 or the President John Whitlock on 638 1142 between 7 and 9pm, or by coming along to any meeting, preferably the next!

FORTH GROUP

The Sydney Forth Group meets monthly on the second Friday of each month at 7pm at Room L616 of the Morren Brown Building (near Library), University of NSW. Subscriptions are $20pa ($10 for students). For more details contact Peter Tregeagle, 10 Binda Avenue, Yowie Bay 2228.

OSBORNE DIFFICULTIES

The 'phone number published in the December issue for the Osborne Users Group should not be used. Ian MacCulloch has left that number.

ILLAWARRA MICROBEE COMPUTER CLUB

The group meets on the 4th Monday of the month (from February to November) at the Wollongong Institute of Education, Norfields Avenue, Gwynneville at 7.30pm.

For further details contact Ronald Reed on (042) 71 2384 or write to the group C/- 49 Beatus Street, Unanderra 2526.

QUEENSLAND

TI BRISBANE USER GROUP

The group has asked that we publish amended details as follows:

TIBUG,
P.O. Box 57,
Aspley, 4034

The co-ordinator is Cheryl Bailey (263 4989) and meetings are held on the last Friday in every month except December at 'Computers and Peripherals', 31 Kate Street, Kedron.

PC1500/PC2 CLUB

The Brisbane PC1500/PC2 Club meets at 7.30pm every third Thursday of the month at Kelvin Grove BCAE Room E/315. All are welcome. 'Phone Chris on (07) 395 1952 A.H. for more details.

VICTORIA

MC-10 6803 USERS

A new computer user group has been formed by Frank Rees for MC-10 6803 users. A special invitation is given to all past and present Dream 6800 users to join. If you wish to join and share ideas with others throughout Australia and NZ via medium of correspondence and a news letter then send SSAE for further details to Frank Rees, 27 King Street, Boort, Victoria.

MELBOURNE PC USER GROUP

All users of IBM and compatible personal computers interested in attending MELB-PC meetings should contact Christopher Leptos, C/- Pannell Kerr Forster, 500 Bourke Street, Melbourne, Victoria 3000. Telephone: B.H. (03) 605 2222.

Late in November '83 the group had its first meeting and elected an interim committee. At our next meeting (February 8th) we will adopt a constitution and formally establish the group.

MELBOURNE PEACH USERS GROUP (MPUG)

A special interest group of MICOM for the Hitachi Peach. The group meets at 8pm on the first Friday of each month at the Templestowe Technical College, Cypress Avenue, Templestowe. For enquiries write to MPUG, P.O. Box 191, Rosanna 3084 or phone Branko on (03) 434 2541 (decent hours).

HITACHI PEACH PUBLIC DOMAIN (HPPD) —

formerly known as Peach Software Exchange (PCX) has moved to Victoria. For details write to P.O. Box 191, Rosanna 3084 or phone Branko on (03) 434 2541 (decent hours).

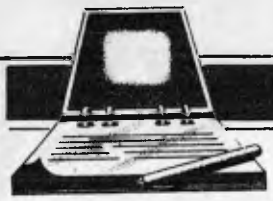
ACT

CANBERRA MICROBEE USERS GROUP

The Group began towards the end of 1982 with a small number of enthusiasts (mainly those who had built Bees from kits) meeting on Saturday afternoons at the first MicroBee shop to open in Canberra. Membership as at December 1983 is about 200 including a large number from outside Canberra (as far away as Melbourne and Perth). A formal constitution was adopted on 16 August 1983.

The Group publishes a newsletter each month (#12 was published in December 1983). All contributions are welcome (from members or non-members). Advertising space is available at reasonable rates.

The Group meets on the third Tuesday of each month at 7.30pm at the Woden Valley High School. Visitors are welcome to attend. The Convenor is Bill Horsfall (6 Boyland Close, Spence, A.C.T. Telephone: (062) 58 3193).



DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Sydney	The Australian Personal Computer Show Contact: Australian Exhibition Services (03) 20 1208	March 14-17, 1984
Singapore	International Business Equipment & Computer Show	March 13-17, 1984
Hanover	Hanover Fair. Contact: (02) 29 3998	April 11-14, 1984
Sydney	Data '84 Contact: Graphic Directions (02) 212 4199	May 22-24, 1984
Perth	International Microcomputer Conference and Exhibition Contact: (09) 325 4427	May 22-24, 1984
Perth	Microcomputer Exhibition Contact: Jenna Ledgerwood (09) 325 0111	May 22-25, 1984

NETWORK NEWS

Steve Withers and Peter Tootill return with another look at the world of telephone networking.

First of all, an apology to those who missed Network News last month. Family commitments around the Christmas period placed a severe strain on our schedules.

A drastic move

The Bettisfield RCP/M system (U.K.) has now closed down, as the Sysop has decided to settle in the West Indies (perhaps it is something to do with their cricket team). Expect to see the number of Jamaica RCP/M in a few months time.

File transfer between computers

There are several methods of transferring files between computers by telephone The simplest is to send the file in ordinary ASCII code, with no error checking or correction procedures. Even machine code can be sent this way by translating the individual bytes into ASCII representations of the two halves. For example, the byte 'FE' which requires 8 bits to send as it stands, can be transmitted by a system using 7-bit word length by sending a letter 'F' followed by a letter 'E'. This requires two bytes and makes transmission twice as long. It is, however, the only way machine code files can be transferred without special procedures.

The problem with sending data via the telephone is that a noise on the line can corrupt the data. This may not be a serious problem with say, a text file, as the human brain is very good at compensating for such errors from clues in the surrounding text. However, in a computer program a small error could be disastrous, and may not be easy to find, especially in machine code. One way to reduce the probability of such errors is to transmit the file in blocks, and to calculate the checksum of each block, with the receiving computer requesting re-transmission if the checksum doesn't agree with that sent by the transmitting system. This is not a complete solution since two errors may compensate for each other to produce a correct checksum even though the data is wrong, but it is a great improvement on sending files with no validation at all. More advanced methods will use complex checks on the data, and can give virtually 100% error-free transmission.

One particular set of protocols for improving the reliability of transmission of data was developed by Ward Christensen for inclusion in his Modem and Xmodem series of intelligent terminal programs written for CP/M systems. These protocols, often referred to as CP/M or Xmodem protocols, have been applied to other systems, and have become a popular standard in North America. They are incorporated in many smart terminal packages (and by the MicroBee network ROM) and often supported by bulletin boards and Remote CP/M systems, making for much more reliable downloading of programs than would otherwise be possible. They use an eight bit standard (with no parity) and can transmit machine code without the need to translate them into ASCII code first.

If you are thinking of writing smart terminal software, consider including Xmodem protocols in the package. (We hope to be able to give details on this in the near future.)

Interest still rising

Bulletin board System Operators ('Sysops') are still experiencing a steady rise in the interest in their systems, and the amount of traffic they get. When Peter's system was running part time last year, it used to get a handful of calls a week. This spring when it went on to 24 hours a day operation, the number quickly rose to half a dozen or so a day. Now 30 or 40 calls a day is the order of things, and the number still seems to be rising steadily! Telecom must be delighted.

Network jargon: X-On/ X-Off protocol

When you call a bulletin board system and read a message, it's not really good enough for the system just to keep sending the message non-stop until it reaches the end, taking no account of whether you can keep up with it or not. You may want to read the top before it scrolls off the screen, or make a note of a phone number or something. What is required is a way of telling the system to 'hang on a minute', and indeed most systems provide such a facility. You simply press the 'P' key (or sometimes the 'S' key) at your end and output will pause until you send a carriage return. Something of the same sort is needed when two computers are exchanging data. For example transferring a file or a program from the bulletin board to your system (usually called 'down-loading'; if you send the file to the BBS, it's called 'uploading'). The receiving computer may need to pause, to save a part of the file to disk for example. One way of requesting such a pause is to send an 'X-off' character (control S, ASCII code 19 decimal, also called DC3). The system, if it supports this protocol will immediately pause until it gets an 'X-on' character (control Q ASCII code 17 decimal, also called DC1), when it will restart. With some systems 'X-on' is not specifically required, and any character will cause transmission to restart. Most bulletin board systems support X-on/X-off protocol for transfer of ASCII files, but it is not required if you are using the XMODEM, or CP/M protocols described in December as they include their own 'handshaking' to prevent data being sent when the receiver is not ready.

Australian systems

Micro Design Lab RCPM Tel: (02) 663 0151. System Operator: Stephen Jolly. Hours: 5pm—7am weekdays, 24 hours weekends.

Mi Computer Club BBS Tel: (02) 662 1686. Program down-loading. Hours: 24 hours daily.

Sydney Public Access RCPM Tel: (02) 808 3536. System Operators: Barrie Hull and David Simpson. Hours: 24 hours daily.

Software Tools RCPM Tel: (07) 378 9530. Hours: 24 hours daily.

MICOM CBBS Tel: (03) 762 5088. System Operator: Peter Jetson. Hours: 24 hours daily.

Gippsland RCPM Tel: (051) 34 1563. System Operator: Bob Sherlock. Hours: 24 hours daily.

Sorcerer Computer Users Association CBBS Tel: (03) 836 4616. System Operator: Bruce Alexander. Program down-loading for SCUA members. Hours: 24 hours daily.

TARDIS RCPM tel: (03) 67 7760. Hours: 6pm—8am weekdays. 24 hours weekends.

Perth RMP/M Tel: (09) 367 6068. Hours: 6pm—9pm WST.

This information is correct and current to the best of my knowledge, but I would be pleased to receive corrections and updates to: Steve Withers, C/- *Australian Personal Computer*, 77 Glenhuntly Road, Elwood, Vic 3184.

American/Canadian systems

TYPE	SYSTEM NAME	NUMBER	NOTES
Forum 80	HQ system	0011 1816 861 7040	
CBBS	HQ system	0011 1312 545 8086	
FBBS	HQ system	0011 1312 677 8514	
ABBS	Ottowa, Ontario	0011 1613 725 2243	
ABBS	HQ system	0011 1703 255 2192	
MABBS	Fort Walton Beach	0011 1904 862 1072	
Bull-80	Alabama	0011 1205 492 0373	
Conn-80	Colour Computer	0011 1212 441 3755	colour graphics for TRS-80 Colour

European systems

ELFA	ABC-MONITOR Sweden	00114.68 7300706	Half duplex
ABC-Banken	Halmstadt, Sweden	00114.63 5110771	
ABC-MONITOR	ABC Club of Sweden	00114.68 801523	Passwords required
CBBS	Gothenburg, Sweden*	00114.63 1292160	75/1200 baud
		00114.63 1690754	300 baud

* After receiving the tone and connecting your modem, either type: <C/R> or type: <COM C/R>. The system then asks for a password which is: 'cbbs' *in small letters!!* If you only get '>' when you dial up, the system needs resetting and you type <I> C/R.

UK systems

CBBS	North East	0011 44 207 543555	
CBBS	London	0011 44 1 399 2136	
Forum-80	Hull	0011 44 482 859169	
Forum-80	London	0011 44 1 902 2546	
Forum-80	Milton	0011 44 908 613004	
Mailbox-80	Liverpool	0011 44 51 428 8924	
TBBS	London	0011 44 1 348 9400	ring-back system
TBBS	Blandford	0011 44 258 54494	
BBS	Southern	0011 44 243 5111077	ring-back system

MICRO EXCHANGE

All Micro Exchange ads must be submitted by readers on the appropriate form (or a photocopy). Maximum of 30 words. Print one word per box, very clearly. Contact name and telephone number/s must be included in the 30 words. All ads must be accompanied by a fee of $5.00 for Australioan Personal Computer or $7.50 for inclusion in both Australian Personal Computer and Australian Business Computer. Make cheques or Postal Orders payable to Micro Exchange. Ads cannot be repeated (unless sent on another form) and we cannot guarantee to print an ad in any specific issue. Please help the typesetter by printing very clearly. Send your form to: Micro Exchange, P.O. Box 62, Middle Brighton, Vic 3186.

NEW SOUTH WALES

8/16 BIT S100 MEMORY BOARDS 16K, 64K, 256K. ALL RUN WITH AN ERG 68000 SYSTEM. BEST OFFERS. PHONE ADRIAN (02) 349 3684.

ALL VZ200 OWNERS - 8 PROGRAMME PACK SAVE HEAPS NOW ONLY $20.00 POST FREE. SEND TO ALES SOFTWARE 39 READING AVE, KINGS LANGLEY NSW 2147

ANOTHER VIC 20 GIFT BONANZA. 4 PROGRAMME EDUCATION PACK PLUS DOCUMENTATION NORMAL PRICE $40.00 GIFT PRICE $19.95 INCLUDES LATEST CATALOGUE. SEND TO ALES SOFTWARE 39 READING AVE, KINGS LANGLEY NSW 2147.

APPLE USERS, LARGE RANGE SOFTWARE, HARDWARE AND ACCESSORIES AT BARGAIN PRICES. SEND LARGE S.A.E. FOR PRICES OR $5.00 FOR 80 PAGES OF DETAILED INFO. NALCO, P.O. BOX 285 RYDALMERE 2116 (02) 638 2980

APPLE, FRANKLIN, MEOFLY AND NEOSHO SOFTWARE, HARDWARE AND ACCESSORIES AT REDUCED PRICES. SEND $5 FOR OVER 80 PAGES OF DETAILED INFO AND REVIEWS. NALCO P.O. BOX 285 RYDALMERE 2116. (02) 638 2980

COMMODORE 64 SOFTWARE DATA 64 DATABASE PROGRAM FOR DISK ($30) OR TAPE ($25). SEND FOR FREE LIST OF PROGRAMS AVAILABLE. SIMA SOFTWARE 34 DE GRAAFF ST, HOLDER A.C.T. 2611

CROMENCO C10-SP TWO DSDD 390K DISKS, STRUCTURED BASIC, WP, SPREADSHEET, DOS CP/M DDS. RS232C CENTRONICS PORTS INCLUDES Z80 MACRO ASSEMBLER. ANTHONY CALLINAN 7/2 GROSVENOR STREET KENSINGTON 2033 PHONE (02) 633 2017 A.H.

HITACHI PEACH 32K. $800.00; M.P.I. DS/DD DRIVE, CONTROLLER $550.00; KAGA GREEN SCREEN, MONITOR $200.00; STAR DP848D PRINTER $350.00; MANUALS, CABLES, SOME PROGRAMS INCLUDED. THE LOT $1,800.00 ONO PHONE PETER (063) 36 1615 A.H.

HORSE RACING ANALYSIS. TO DATE EVERY DOLLAR INVESTED AT T.A.B. RETURNS $2.40. CASSETTE AVAILABLE FOR SINCLAIR ZX81 AND SPECTRUM WITH INSTRUCTIONS ONLY $25.00. ORDER NOW PETER GARDINER, LIGHTNING RIDGE 2834.

IBM PC MONO DISPLAY AND PRINTER ADAPTOR CARD WITH IBM DISPLAY $900 IBM PC PRINTER $800 2 X 160K DRIVES $300 EACH ALL ITEMS AS NEW PRINTER NEVER USED B.H. (02) 502 2982 A.H. (02) 768414

TRS-80 SOFTWARE TRADE/SELL: SEND ORIGINAL TRS-80 CASSETTE PROGRAM OR $10.00 FOR COPY OF SPACE PIRACY A CONQUEST/TRADE GAME: SSAE MR E HUGHES 52 LOWRY STREET, CARDIFF NSW 2285.

WANTED: RADIO SHACK MODEL II WITH PICKLES AND TROUT CP/M OPERATING SYSTEM ALSO ANY ENGINEERING OR MATHEMATICAL PROGRAMS WRITTEN FOR COMMODORE 64 APPLE2E AND TRS MODEL II. PHONE JOHN (02) 439 7780 A.H.

VICTORIA

64K RAM INSTALLED IN TRS-80 COLOUR COMPUTER FOR $95.00 DROP OFF AND PICK UP THE NEXT DAY. PLEASE RING FIRST. DON MCKENZIE, 29 ELLESMERE CRES., TULLAMARINE 3043 (03) 338 6286.

APPLE-2 COMPATIBLE DISKS FROM $299. ALSO 6502 + Z 80 DUAL PROCESSOR, NUMERIC KEYPAD, 188 FUNCTION KEYS, 10 USER'S DEFINE KEYS. FROM $625. OR COMES WITH SEPERATE KEYBOARD. WRITE TO P.O. BOX 145 MULGRAVE VIC. 3170

COMODORE 64 TO IEEE INTERFACE CARTIDGE. BRAND NEW. SELL FOR $120.00 (NEW PRICE: $175.00) PHONE FRITZ (03) 754 6765.

FIT 64K, 64K? YES 64K OF USABLE RAM IN SYS-80 AND TRS-80 MODEL ONE COMPUTERS FOR AROUND $70.00. SEND $5.00 FOR INSTRUCTIONS TO DON MCKENZIE 29 ELLESMERE CRES, TULLAMARINE 3043.

FOR SALE: MICRODANGELO MA520 S100 GRAPHICS BOARD WITH SCREENWARE PACII. SELL $1,800 PHONE RICHARD SBRANA B.H. (03) 529 2722 A.H. (03) 689 5362.

FOR SALE: TANDON 5.25" DISC DRIVE MODEL TM-100 SS 80 TRK. INCLUDES BOX & POWER SUPPLY. SELL $350.00 PHONE RICHARD SBRANA B.H. (03) 529 2722 A.H. (03) 689 5362.

FOR SALE: ADS 6809 SINGLE-BOARD CPU FOR S100. BARE PCB. INCLUDES LISTING FOR MONITOR SELL $60.00. PHONE RICHARD SBRANA B.H. (03) 529 2722 A.H. (03) 698 5362

FOR SALE: BASE 2 PRINTER MODEL BOOMST. SELL $300.00 PHONE RICHARD SBRANA B.H. (03) 529 2722 A.H. (03) 689 5362.

HARDWARE HACKERS. SPEED UP YOUR TRS-80 MODEL ONE, OR SYS-80 TO THREE TIMES NORMAL SPEED. 5.3 MHZ. BENCHMARK TESTS COMPARE CLOSELY TO I.B.M. PERSONAL COMPUTER. BARE P.C. BOARD $17.90 DON MCKENZIE (03) 338 6286

NEW PET GAMES: PLANET DEFENDER $13.00, FASTSKI $14.00, LUNAR LANDER $12.00,TRAPBALL $9.99, AIRSTRIKE $12.00, PDARR $13.00, DEATHMISSION $13.00, TEN PIN BOWLING $12.00, FREE CATALOGUE - ANTHONY DOUGLASS, 8 FAIRYDELL RD, 3160 TECOMA.

NEW VIC GAME: LUNAR MISSION $14.99,COMMODORE 64: FASTSKI $14.99. BOTH GAMES FEATURE HIGH RESOLUTION GRAPHICS, COLOUR AND SOUND. WRITE FOR FREE CATALOGUE TO ANTHONY DOUGLASS 8 FAIRYDELL RD, 3160 TECOMA.

PRINTER EPSON MX 80, EXCELLENT CONDITION, FITTED IEEE INTERFACE AND CABLE. READY FOR USE ON

Goto to page 181

PROGRAMS

APC is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs to APC please include the following:
(a) A cassette or disk of the program.
(b) A listing on plain, white paper (typewritten if no printer available).
(c) Comprehensive but brief documentation.
(d) A suitable SAE if you would like your materials to be returned after use.
Please mark (a), (b) and (c) with your name, address, program title, machine (state minimum RAM where appropriate) and — if possible — a daytime number. All programs must, please, be fully debugged. Programs are paid for at the rate of $20 per page of published listing, plus a $50 bonus for the Program of the Month. Send contributions to: APC Programs, 77 Glenhuntly Road, Elwood, Vic 3184.
We'll do our best to acknowledge receipt of programs as quickly as possible, but following this acknowledgement it will usually be some time before a decision can be made, so please be patient! Generally speaking, programs which are rejected for any reason are returned fairly quickly, so 'no news . . .'

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

TRS-80/System 80 Pascal Procedures

by John Gale

The Tandy 'Tiny Pascal' compiler often provides TRS-80 and System 80 owners with their first taste of a language other than Basic. While offering significant improvements on TRS-80 Basic in terms of both structure and execution time, 'Tiny Pascal' lacks some fairly fundamental features. John Gale set out to produce some useful Pascal procedures to augment the statements provided by Tandy.

PROCLP(CH) sends a single character (CH) to the printer. The primary use of this is to send control codes to the printer. Note that this procedure only works on the System 80 because of the TRS-80's insistence on using memory location 14312 to communicate with the printer. TRS-80 owners should substitute the following:

```
PROC LP(CH);
BEGIN WHILE MEM(14312)<> 0 DO;
  MEM(14312):=CH
END;
```

PROCLLIST lists Tiny Pascal source code to the printer.

PRO CLS is simply a mnemonic to clear the screen, used in place of the oft-typed WRITE(28,31).

PROCDUMP (first line, last line) dumps a text screen to printer, PROC DUMP (0,15) dumping the whole screen.

PROC GRDUMP (first line, last line) does the same for a graphics screen, though this takes considerably longer of course.

Finally, PROC AT (line, column) provides a much-needed PRINT @ facility. This is a feature which most TRS-80/System 80 owners come to rely on to keep screen displays neat. It works in a non-standard form, but is just as easy to use.

The listing here contains a short demonstration program which uses all the procedures defined.

PROGRAMS

```
(*A package of Tiny Pascal utilities*)
VAR FIRST,KEY,L,X,Y:INTEGER;
(*-------------------------------------------------------------*)
PROC LP(CH); (*sends a single chr from VG to printer*)
BEGIN WHILE INP(253)<>63 DO;
   OUTP(253,CH)
END;
(*-------------------------------------------------------------*)
PROC LLIST; (*lists a Tiny Pascal source *)
VAR LOC: INTEGER;
BEGIN LOC:=MEMW(16768); LP(15);LP(27);LP(87);LP(1);
   REPEAT IF MEM(LOC)=9 THEN BEGIN LP(32);LP(32);LP(32) END
      ELSE IF MEM(LOC)<>10 THEN LP(MEM(LOC));
      LOC:=LOC+1
   UNTIL (LOC-1)=MEMW(16770)
END;
(*-------------------------------------------------------------*)
PROC CLS; BEGIN WRITE(28,31)  END; (*clears screen*)
(*-------------------------------------------------------------*)
PROC LDUMP(K,N); (*used by DUMP and NOW*)
VAR B,C: INTEGER;
BEGIN FOR C:=K TO N DO
   BEGIN B:=MEM(C);
      IF B<32 THEN LP(B+64) ELSE IF B>127 THEN LP(32)
      ELSE LP(B)
   END;
   LP(13)
END;
(*-------------------------------------------------------------*)
PROC DUMP(F,L); (*dumps VDU lines F to L to printer*)
VAR J: INTEGER;
BEGIN IF F<=L THEN
   FOR J:=(F AND 15) TO (L AND 15) DO
      LDUMP(15360+J*64,15423+J*64)
END;
(*-------------------------------------------------------------*)
FUNC PRINTER; (*remembers first VDU position to print*)
BEGIN FIRST:=MEMW(16416); PRINTER:=0 END;
(*-------------------------------------------------------------*)
FUNC NOW; (*writes to printer*)
BEGIN LDUMP(FIRST,MEMW(16416)-1); NOW:=0 END;
(*-------------------------------------------------------------*)
PROC GRLINE(J); (*used by GRDUMP*)
VAR X,Y,B:INTEGER;
BEGIN Y:=3*J;
   FOR X:=0 TO 127 DO
      IF POINT(X,Y) THEN LP(64) ELSE LP(32);
   Y:=Y+1; LP(13);
   FOR X:=0 TO 127 DO
      IF POINT(X,Y) THEN LP(64)
      ELSE IF (X AND 1) THEN LP(32)
      ELSE BEGIN
         B:=MEM(15360 + J SHL 6 + X SHR 1);
         IF B<32 THEN LP(B+64)
         ELSE IF B>127 THEN LP(32) ELSE LP(B)
      END;
   Y:=Y+1; LP(13);
   FOR X:=0 TO 127 DO
      IF POINT(X,Y) THEN LP(64) ELSE LP(32);
   LP(13);
END;
(*-------------------------------------------------------------*)
PROC GRDUMP(F,L); (*graphics dump of lines F to L to printer*)
VAR J: INTEGER;
BEGIN LP(27);LP(64);LP(15);LP(27);LP(51);LP(22);
      (*setting Epson control codes*)
   FOR J:=F TO L DO GRLINE(J);
   LP(27);LP(64);LP(27);LP(51);LP(36);
      (*restore normal Epson settings*)
END;
(*-------------------------------------------------------------*)
FUNC AT(L,C); (*positions cursor at line and column*)
   BEGIN MEM(MEMW(16416)):=32;
      MEMW(16416):=15360+((L*64+C) AND 1023);
      AT:=0 END;
(*-------------------------------------------------------------*)
BEGIN (*demonstration program*)
   CLS;LP(27);LP(64);
   WRITE(PRINTER,'TINY PASCAL printer procedures',NOW);
   WRITE(PRINTER,'The following illustrates DUMP(4,12);',NOW);
   LP(13); LP(13); LP(13); CLS;
   FOR L:=0 TO 15 DO WRITE(AT(L,L),'THIS IS VDU LINE ',L£);
   DUMP(4,12); CLS;
   LP(13); LP(13); LP(13);
   WRITE(PRINTER,'and this illustrates GRDUMP(0,15);',NOW);
   LP(13); LP(13); LP(13); CLS;
   FOR Y:=0 TO 47 DO
      FOR X:=0 TO 127 DO
         IF (X*X+Y*Y) MOD 85 > 53 THEN PLOT(X,Y,1);
   WRITE(AT(7,20),'....DEMONSTRATION.....');
   WRITE(AT(8,20),'...OF GRDUMP(0,15)....');
   GRDUMP(0,15); LP(13); LP(13); CLS;
   WRITE(AT(13,10),'LLIST?  HIT  Y  OR  N');
   REPEAT KEY:=INKEY UNTIL (KEY='Y') OR (KEY='N');
   IF KEY ='Y' THEN LLIST;
END.
```

PET Maths Maze

by Daniel Lawson

'Maths Maze' is an educational program for a 4000-series Commodore PET. It is aimed at the primary school level.

The program persents the user with a maze. The child moves through the maze using the keys U)p, D)own, L)eft and R)ight, but before a move can be made, the child must solve an arithmetic problem. The program adjusts itself to the ability of the user by testing the score at the end of the Maze. Less than 40% correct results in an easier maze, greater than 60% a more difficult one. Instructions are contained within the program.

```
2 REM"MATHS MAZE 2"
5 POKE144,88
6 GOSUB9000
7 POKE59468,14
8 GOSUB8000
10 B=0:V=0
12 PRINT"NTER -IRECTION  DU oISH |O |O"
13 PRINT"EFT:IGHT:P:OWN"
15 M=33248
20 FORA=33248TO33254
30 POKEA,160
40 NEXTA
50 FORS=33254TO33054 STEP-40
60 POKES,160
70 NEXTS
80 FORA=33054 TO33070
90 POKEA,160
100 NEXTA
110 FORS=33070TO33190 STEP40
120 POKES,160
130 NEXTS
140 FORA=33062 TO33182 STEP40
150 POKEA,160
160 NEXTA
170 FORS=33254 TO33454STEP40
180 POKES,160
190 NEXTS
200 FORA=33454TO33458
210 POKEA,160
220 NEXTA
230 FORS=33458TO33338STEP-40
240 POKES,160
250 NEXTS
255 GOSUB5000
260 POKEM,77
270 GETQ$:IFQ$="" THEN270
280 IFQ$="L"THENM=M-1:M1=M+1
285 IFQ$="R" THENM=M+1:M1=M-1
286 IFQ$="D"THENM=M+40:M1=M-40
287 IFQ$="U"THENM=M-40:M1=M+40
289 IFM=33364 THEN500
290 IFPEEK(M)=32 THENM=M1
300 POKEM1,160
310 POKEM,77
320 X%=12*RND(1)+1
330 IFX%>4THENGOSUB1000
350 GOTO270
500 PER=((B-V)/B)*100:IFPER>=60THEN700
510 IFPER>=40THEN600
520 PRINT"
530 PRINT"                    "
540 PRINT"OR GETTING LESS THAN 40% RIGHT YOU "
550 PRINT"SHALL BE RETURNED TO THE START."
560 IFVAL(Y$)>1THENPRINT"N A EASIER LEVEL.
";CO=VAL(Y$):CO=CO-1:Y$=STR$(CO)
570 FORO=1TO5000:NEXTO
580 GOTO10
600 PRINT"
603 PRINT"DU HAD"B-V"OUT OF"B"CORRECT"
605 GOTO620
610 PRINT", SEE YOUR MATHS IS GOOD"
620 PRINT" IT NY EY IO LAY GAIN"
630 PRINT"
640 GETT$:IFT$=""THEN640
645 IFT$="E"THEN660
650 RUN8
660 PRINT"
670 PRINT"
680 FORO=1TO1000:NEXTO:PRINT"":POKE59468,12:NEW
700 PRINT"
710 PRINT"                    "
720 PRINT"DU HAD OVER 60% OF THE QUESTIONS RIGHT."
```

```
730 PRINT"♠S A REWARD YOU CAN PROORESS ONTO THE"
740 PRINT"█NEXT LEVEL.|HIS TIME GETTING A QUESTION"
750 PRINT"█WRONG _⌐| ,_/♥  ⌐, |⌐ | |⌐ ♠|♠_| ,ALSO YOU"
760 PRINT"█MUST GO THROUGH EACH CHECK POINT,+."
770 PRINT"█████|IT ♠NY /EY |O |EGIN"
780 GETK$:IFK$=""THEN780
790 GOTO8200
1000 B=B+1
1001 IFVAL(Y$)=1THENP%=5*RND(1)+1:L%=5*RND(1)+1:GOTO1010
1003 IFVAL(Y$)=2THENP%=8*RND(1)+1:L%=8*RND(1)+1:GOTO1010
1005 IFVAL(Y$)=3THENP%=12*RND(1)+1:L%=12*RND(1)+1:GOTO1010
1007 IFVAL(Y$)=4THENP%=15*RND(1)+1:L%=15*RND(1)+1
1010 Y%=3*RND(1)+1
1012 IFY%=1 THEN1100
1015 IFY%=2 THEN1300
1020 PRINT"████"P%" + "L%"="
1030 GOSUB8100
1037 PRINT"████                    "
1040 IFW=P%+L% THEN RETURN
1050 PRINT"████ANSWER= "P%+L%
1052 FORR=1TO500:NEXTR
1054 PRINT"████
1055 IFRIG=33295THENPOKEM,102:POKERIG,205:M=RIG
1075 V=V+1
1080 RETURN
1100 PRINT"████"P%" X "L%"="
1110 GOSUB8100
1130 PRINT"████
1140 IFW=P%*L%THENRETURN
1150 PRINT"████ANSWER= "P%*L%
1155 FORO=1TO500:NEXTO
1160 PRINT"████                 "
1170 IFRIG=33295THENPOKEM,102:POKERIG,205:M=RIG
1187 V=V+1
1190 RETURN
1300 IFL%>P% THEN1400
1308 PRINT"████"P%"█- "L%"="
1310 GOSUB8100
1315 PRINT"████                 "
1325 IFW=P%-L% THENRETURN
1330 PRINT"████ANSWER= "P%-L%
1340 FORR=1TO500:NEXTR
1350 PRINT"████
1370 IFRIG=33295THENPOKEM,102:POKERIG,205:M=RIG
1385 V=V+1
1390 RETURN
1400 PRINT"████"L%"█- "P%"="
1410 GOSUB8100
1415 PRINT"████                 "
1425 IFW=L%-P% THENRETURN
1430 PRINT"████ANSWER= "L%-P%
1440 FORR=1TO500:NEXTR
1450 PRINT"████
1470 IFRIG=33295THENPOKEM,102:POKERIG,205:M=RIG
1485 V=V+1
1490 RETURN
5000 FORA=33338TO33358
5010 POKEA,160
5020 NEXTA
5030 FORS=33348TO33228 STEP-40
5040 POKES,160
5050 NEXTS
5060 FORA=33230TO33215 STEP-1
5070 POKEA,160
5080 NEXTA
5090 FORS=33358TO33158STEP-40
5100 POKES,160
5110 NEXTS
5120 FORA=33150TO33159
5130 POKEA,160
5140 NEXTA
5150 FORS=33160TO33520 STEP40
5160 POKES,160
5170 NEXTS
5180 FORA=33520TO33505 STEP-1
5190 POKEA,160
5200 NEXTA
5210 FORS=33505TO33345STEP-40
5220 POKES,160
5230 NEXTS
5240 FORA=33360TO33364
5250 POKEA,160
5260 NEXTA
5270 RETURN
8000 PRINT"█████████████████NATHS NAZE"
8005 PRINT"████████████████  ────   ────"
8010 PRINT"█ OU,\,ARE IN A MAZE,THE ONLY WAY TO "
8020 PRINT"█ESCAPE IS TO ANSWER THE MATHS QUESTIONS."
8030 PRINT"♠IM FOR A HIGH PERCENTAGE OF THE "
8040 PRINT"█QUESTIONS RIGHT"
8050 PRINT"███████████████████|| ⌐ L /─'"
8060 PRINT"█████⌐/|─ ─ ~─,-⊥| | L⌐X⌐L:-"
```

PROGRAMS

```
8062 PRINT"▒▒1▒-¬ASY:▒2▒-♠VERAGE:▒3▒- |ARD"
8070 GETY$:IFY$=""THEN8070
8072 IF VAL(Y$)<1 OR VAL(Y$)>3THEN8000
8080 RETURN
8100 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"II$;" "
8105 IFLEN(II$)>5THENII$="":GOTO8100
8110 GETI$:IFI$=""THEN8110
8120 IFI$=CHR$(20)ANDII$=""THEN8110
8130 IFI$=CHR$(20)THENII$=LEFT$(II$,LEN(II$)-1):GOTO8100
8140 IFI$<>CHR$(13)THENII$=II$+I$:GOTO8100
8150 W=VAL(II$)
8160 II$=""
8170 RETURN
8200 PRINT"▒"
8205 CO=VAL(Y$):CO=CO+1:Y$=STR$(CO)
8210 PRINT"▒▒▒▒▒▒NTER -IRECTION |OU oISH |O |O"
8220 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒EFT:▒▒IGHT:▒▒P:▒▒OWN"
8230 PRINT"▒▒▒"
8240 PRINT"                 ▒▒▒▒▒▒▒▒▒▒"
8250 PRINT"                 ▒        ▒▒▒▒▒▒▒▒"
8260 PRINT"                 +               ▒"
8270 PRINT"             ▒▒▒▒▒     ▒▒▒▒▒+▒▒▒▒▒"
8280 PRINT"              ▒        ▒"
8290 PRINT"              ▒        ▒"
8300 PRINT"     ▒▒▒▒▒▒▒▒▒         ▒"
8310 PRINT"          ▒         ▒▒▒"
8320 PRINT"          ▒         ▒"
8330 PRINT"          ▒        ▒"
8340 PRINT"          ▒▒▒▒     ▒▒▒▒▒▒▒▒▒▒▒▒▒"
8350 PRINT"             ▒    ▒            ▒"
8360 PRINT"             ▒    ▒            ▒"
8370 PRINT"             ▒▒+▒▒▒            |"
8380 M=33295:RIG=M:POKEM,205:POKE33594,200
8390 GETT$:IFT$=""THEN8390
8400 IFT$="U"THENM=M-40:M1=M+40
8410 IFT$="D"THENM=M+40:M1=M-40
8420 IFT$="L"THENM=M-1:M1=M+1
8430 IFT$="R"THENM=M+1:M1=M-1
8440 IFPEEK(M)=32THENPOKEM1,205:M=M1:GOTO8390
8450 IFM=33594THEN8500
8460 POKEM1,102:POKEM,205
8470 IFRND(1)>.2THENGOSUB1000
8480 GOTO8390
8500 IFPEEK(33144)=91THEN8550
8510 IFPEEK(33193)=91THEN8550
8520 IFPEEK(33583)=91THEN8550
8530 GOTO600
8550 PRINT"▒▒▒▒▒ |OU HAVEN'T BEEN THROUGH ♠LL THE CHECK"
8560 PRINT"POINTS.|♠¬ |Γ | Γ ♥|♠_|  Γ, |Γ."
8570 FORO=1TO3000:NEXTO
8580 PRINT"▒▒▒▒▒                                      "
8590 PRINT"                                    "
8600 POKEM1,102:GOTO8380
9000 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
9020 PRINT"  ●    ●   ●●●●   ●●●●●●  ●    ●  ●●●●● "
9030 PRINT"▒ ●●  ●●  ●     ●    ●●    ●     ●   ●   ●"
9040 PRINT"▒ ● ●● ●  ●     ●    ●●    ●●●●●●     ●"
9050 PRINT"  ●    ●  ●●●●●●     ●●    ●●●●●●     ●"
9060 PRINT"  ●    ●  ●     ●    ●●    ●     ●  ●  ●"
9070 PRINT"  ●    ●  ●     ●    ●●    ●     ●  ●●●●●"
9080 PRINT"   ●   ●    ●●●●    ●●●●●●   ●●●●●●"
9090 PRINT"   ●● ●●   ●    ●       ●     ●"
9100 PRINT"   ● ●● ●  ●    ●      ●      ●●●●"
9110 PRINT"   ●    ●  ●●●●●●     ●       ●●●●"
9120 PRINT"   ●    ●  ●    ●    ●        ●"
9130 PRINT"   ●    ●  ●    ●   ●●●●●●    ●●●●●●"
9140 FORO=1TO3:PRINT"▒":NEXTO
9150 J$="BY DANIEL LAWSON.COPYRIGHT 1983"
9160 FOR E=1TOLEN(J$)
9170 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"RIGHT$(J$,E)
9180 NEXTE
9190 FORO=1TO1000:NEXTO
9200 RETURN
```

BBC Logic Tree

by Robert Armstrong

'Logic Tree' is a program for either model BBC. Presented loosely in the form of a simple game, it allows the user to gradually build up a binary tree (refer to a Basic textbook if you are unfamiliar with the concept). It is likely to prove a useful teaching aid in that it demonstrates how a tree is formed and the way in which it is used.

To use the program for the first time, you will need to input a subject. This can be anything you like, but it is best to stick to concrete nouns when using the program with young children. You then enter

examples, supplying answers to the computer's questions as you go. The tree will carry out a search following each additional branch and request further details if the search fails.

The syntax requires attributes rather than properties of objects, since the questions asked are based on 'Can the object . . .?' rather than 'Is the object . . .?', but this is easily changed if required. Once a tree is complete, it may be saved on disk for future use. Function key 0 prints the array holding the data so that you are able to see how the tree is structured.

```
10REM TREE STRUCTURE GAME
20    ******************
30
40MODE7
50PROCinit
60REPEAT
70PROCsearch_tree
80PROCend_of_tree
90PROCanother_go
100UNTILFALSE
110     DEFPROCinit
120     ***********
130
140ON ERROR GOTO2760
150REM disable escape
160*FX220,0
170REM this shows how the tree is built up (after leaving prog use f0)
180*KEY0F.I=1TO10:P.TREE$(I,1);"  ";TREE$(I,2);"  ";TREE$(I,3):N.:M
190DIM TREE$(100,3)
200REM lower case
210*FX202,48
220REM set VDU7 duration (FX213 sets pitch)
230*FX214,1
240REM assign colours eg r=RED
250r=129
260g=130
270y=131
280m=133
290b=134
300num=1
310newnum=1
320type$="TREE GAME"
330PROCheader
340PROCinstruct
350CLS
360PRINT
370PROCprint(b,"Shall I load the file you saved last time?")
380PROCyes_no
390CLS
400PROCoff
410IF ans PROCload_datafile ELSE PROCfirst_data
420PROCoff
430PROCdelay(60)
440PRINT''''CHR$g;"Here we go....."
450PROCdelay(200)
460PROCon
470PROCheader
480ENDPROC
490     DEFPROCfirst_data
500     *****************
510
520PRINT
530PROCprint(0,"OK. I will ask you some questions to start a new tree.")
540PROCdelay(200)
550PRINT''''CHR$g;"Here we go....."
560PROCdelay(200)
570CLS
580PROCon
590PRINT
600PROCprint(b,"What tree do your objects belong to?")
610PRINT
620PROCtext_col(y)
630INPUT"They are from the tree of "type$
640IF RIGHT$(type$,1)="s" type$=LEFT$(type$,LEN(type$)-1)
650PRINT
660PROCprint(b,"What shall I ask you first about the "+type$+"?")
670PRINT
680PROCprint(y,"Ask me if the "+type$+" can ")
690INPUT""TREE$(1,1)
700PRINT
710PROCprint(b,"If the "+type$+" could "+TREE$(1,num)+" what type of
        might it be?")
720PRINT
730PROCtext_col(y)
740INPUT"It might be "TREE$(1,2)
750PRINT
760PROCprint(b,"If the "+type$+" could not "+TREE$(1,num)+" what type of
"+type$+" might it be?")
770PRINT
780PROCtext_col(y)
790INPUT"It might be "TREE$(1,3)
800next=2
810ENDPROC
```

PROGRAMS

```
820      DEFPROCsearch_tree
830      ******************
840
850CLS
860pos=-1
870REPEAT
880pos=pos+1
890num=newnum
900PROCtext_col(b)
910PRINTTAB(0,pos)"Does the ";type$;" you are thinking of
"'TREE$(num,1);"?";
920PROCyes_no
930IF ans reply=2 ELSE reply=3
940newnum=ASC(TREE$(num,reply))-48
950PRINTTAB(0,pos);SPC38
960PRINTTAB(0,pos);CHR$m;TREE$(num,1);
970IF reply=2 PRINTTAB(25)CHR$g"yes";SPC12 ELSE PRINTTAB(30)CHR$r"no";SPC8
980UNTIL newnum>next
990ENDPROC
1000     DEFPROCend_of_tree
1010     ******************
1020
1030PROCprint(0,CHR$11+"Are you thinking of "+TREE$(num,reply)+"?")
1040PROCyes_no
1050IF ans PRINTCHR$g"yes":PROCi_won ELSE PRINTCHR$r"no':PROCupdate_tree
1060newnum=1
1070ENDPROC
1080     DEFPROCupdate_tree
1090     ******************
1100
1110TEMP$=TREE$(num,reply)
1120PRINT'CHR$(r)SPC14"OK, you win."
1130FORI=5 TO 2 STEP-1
1140FORJ=150TO0 STEP-25
1150SOUND17,-(I+10),J+SIN(I^I),I
1160NEXT,
1170PRINT'"What were you thinking of?"
1180PROCtext_col(y)
1190INPUT"I was thinking of 'newtype$
1200PROCprint(b,"What question would  differentiate between
"+newtype$+" and "+ TREE$(num,reply)+"?"+CHR$10+CHR$13)
1210PROCtext_col(y)
1220INPUT"Does it "act$
1230IF RIGHT$(act$,1)="?" act$=LEFT$(act$,LEN(act$)-1)
1240TREE$(next,1)=act$
1250PROCprint(b,"What is the correct answer for "+newtype$+"?")
1260IF POS>36 PRINT
1270TEMP$=TREE$(num,reply)
1280TREE$(num,reply)=STR$(next)
1290PROCyes_no
1300IF ans PRINTCHR$y"yes": reply=2'ELSE PRINTCHR$y"no":reply=3
1310TREE$(next,reply)=newtype$
1320IF reply=2 reply=3 ELSE reply=2
1330TREE$(next,reply)=TEMP$
1340next=next+1
1350newnum=1
1360PROCoff
1370PROCprint(0,"I know "+STR$(next-1)+" "+type$+"s now")
1380PRINT
1390PROCdelay(100)
1400PROCon
1410ENDPROC
1420     DEFPROCyes_no
1430     *************
1440
1450*FX21,0
1460REPEAT
1470ans=GET OR &20
1480UNTIL ans=121 OR ans=110
1490IF ans=121 ans=TRUE ELSE ans=FALSE
1500IF ans THEN *FX213,250
1510IF NOT ans THEN *FX213,50
1520VDU7
1530ENDPROC
1540     DEFPROCi_won
1550     ************
1560
1570PRINT'CHR$136CHR$(g)TAB(16)"I WON!"
1580FORI=5TO 2 STEP-1
1590FORJ=1TO6
1600SOUND17,-(I+10),150*SIN(I^I),I
1610NEXT,
1620PRINT
1630ENDPROC
1640     DEFPROCanother_go
1650     *****************
1660
1670PRINT'"Do you want another go?";
1680PROCyes_no
1690IF ans ENDPROC
1700REM reset
1710*FX202,32
1720*FX220,27
1730*FX213,100
1740*FX214,6
1750CLS
1760PROCprint(b,CHR$10+"Thanks for playing.")
1770PRINT''
```

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PROGRAMS

```
1780PROCprint(0,"Do you want to save the information about "+type$+"s?")
1790PROCyes_no
1800IF NOT ans VDU26,12:PRINTCHR$b"Bye":END
1810file=OPENOUT("$.TREEDAT")
1820PRINT#file,type$,next
1830FOR I=1 TO next-1
1840PRINT#file,TREE$(I,1),TREE$(I,2),TREE$(I,3)
1850NEXT
1860CLOSE#0
1870VDU26,12
1880PRINTCHR$b"Bye"
1890END
1900      DEFPROCload_datafile
1910      **********
1920
1930file=OPENIN("$.TREEDAT")
1940INPUT#file,type$,next
1950FOR I=1TO next-1
1960INPUT#file,TREE$(I,1),TREE$(I,2),TREE$(I,3)
1970NEXT
1980CLOSE#0
1990PROCprint(0,CHR$10+"I have loaded the information from the file")
2000PROCdelay(100)
2010PRINT''
2020PROCprint(0,"I know "+STR$(next-1)+" "+type$+"s")
2030PROCdelay(100)
2040PROCon
2050ENDPROC
2060     DEFPROCdelay(t)
2070     ************
2080wait=INKEY(t)
2090ENDPROC
2100      DEFPROCoff
2110      **********
2120VDU23,1,0;0;0;0;
2130ENDPROC
2140      DEFPROCon
2150      *********
2160VDU23,1,1;0;0;0;
2170ENDPROC
2180      DEFPROCinstruct
2190      ***************
2200
2210PRINT
2220PROCprint(b,"Do you want instructions for the game?")
2230PROCyes_no
2240IF NOT ans ENDPROC
2250CLS
2260PROCoff
2270PRINT
2280PROCprint(0,"You will be asked if you want to load a file containing
information about the tree or answer questions to start a new tree.")
2290PROCdelay(600)
2300PRINT'
2310PRINT"A type of tree might be"
2320PROCdelay(50)
2330PRINTTAB(5)CHR$y"'animals'"
2340PROCdelay(250)
2350PRINT"The first question may be"
2360PROCdelay(50)
2370PRINTTAB(5)CHR$y"'does it walk'."
2380PROCdelay(250)
2390PRINT''"I will ask questions in blue writing.'
2400PROCdelay(50)
2410PROCprint(y,"Your replies will be in yellow.")
2420PROCdelay(700)
2430PRINT''CHR$g;"Here we go....."
2440PROCdelay(400)
2450PROCon
2460ENDPROC
2470      DEFPROCtext_col(c)
2480      ***************
2490REM poke colour outside text window
2500FORI=&7C78+VPOS*40 TO &7FC0STEP&28
2510?I=c
2520NEXT
2530ENDPROC
2540      DEFPROCheader
2550      *************
2560VDU26
2570CLS
2580FORI=1TO2
2590PRINTCHR$(y)CHR$157CHR$132CHR$141SPC((34-LEN(type$))/2);type$
2600NEXT
2610REM text window to leave first col m blank
2620VDU28,1,24,39,3
2630ENDPROC
2640      DEFPROCprint(col,A$)
2650      ************
2660
2670IF col PROCtext_col(col)
2680IF LEN(A$)<39 PRINTA$;:ENDPROC
2690P=39
2700REPEAT
2710P=P-1
2720UNTIL MID$(A$,P,1)=" "
2730PRINT LEFT$(A$,P)
```

```
2740A$=RIGHT$(A$,LEN(A$)-P)
2750GOTO2680
2760REM ERROR ROUTINE
2770     *************
2780
2790IF ERR=129 PRINTCHR$136CHR$r"
THE FILE IS NOT ON THE DISC":PROCdelay(600) :RUN
2800PRINT'"OOPS @ line ";ERL
2810REPORT
2820PRINT'
2830*FX202,32
2840*FX220,27
2850END
```

Grid Bike

by David Pearson

Light cycles on the unexpanded VIC-20, impossible I hear you say — not so, because here they are. This game from David Pearson is a variation on the theme of light cycles called Grid Bike. You are presented with the multi-coloured grid on which some men are stranded.

Your mission is to collect all the men without chashing your bike into the sides of the playing arena or your own trail. On the easy stages this is not really a great problem, but as you progress you will eventually want to try the harder version. Now you not only have to avoid your trail and the screen edges, you also have to dodge around some blocks that have been placed on the grid by the malicious maniacal machine (your computer under control of this program).

Accompanying the program are a set of notes that should help you to convert it to run on machines other than the VIC-20.

The program comes in two parts, the first being a loader program. This loads up the user-defined characters into the memory and gives the playing instructions. The second, which is auto run from the first using the method of POKeing the load/run instructions into the keyboard buffer, contains the game itself. The main program can be run over and over as long as the defined characters are not overwritten, but from a cold start the loader program needs to be used.

LOADER-PROGRAM NOTES

1000	Change the pointers to the string storage and the maximum memory allowed for Basic to leave room for the character definitions.
1010-1020	Define the characters from the data in lines 9010 to 9100.
5000	Print the codes to clear the screen and set text colour to white
5010	Set the screen colours, background and border to black.
5020-5175	Playing instructions and keypress prompt.
5180	Get any key from the keyboard, note that GET does not wait for a keypress and will return null if no key is pressed.
5190	Clear the screen.
5200	A few more instructions.
5300-5400	This POKEs Lo (carriage return) Ru (carriage return) into the keyboard buffer and sets the buffer pointer to 7 for 7 characters.
9000-9100	Data for the defined characters, note that the characters are one per line

LOADER PROGRAM

```
1000 POKE52,28:POKE56,28:CLR
1010 FORI=7168TO7256:POKEI,PEEK(I+25600):NEXT
1020 FORJ=7168TO7256:READQ:POKEJ,Q:NEXT
5000 PRINT"■■"
5010 POKE36879,8
5020 PRINT"       ■ GRID BIKE "
5030 PRINT"■YOU ARE THE DRIVER "
5040 PRINT"OF THE GRID BIKE."
5050 PRINT"YOU MUST DRIVE ROUND "
5060 PRINT"THE GRID PICKING UP"
5070 PRINT"THE PEOPLE."
5080 PRINT"AS YOU DRIVE AROUND"
5090 PRINT"THE GRID YOU LEAVE A"
5100 PRINT"TRAIL."
5110 PRINT"IF YOU RUN INTO IT"
5120 PRINT"YOU WILL BE KILLED."
5130 PRINT"Z=LEFT"
5140 PRINT"X=RIGHT"
5150 PRINT"L=UP"
5160 PRINT",=DOWN"
5170 PRINT"■      PRESS ANY KEY"
5175 PRINT"■■BY D.PEARSON"
5180 GETA$:IFA$=""THEN5180
5190 PRINT"■"
5200 PRINT"THIS PROGRAM LOADS THEGRAPHICS,SO LOAD IT   EVERY
     TIME"
5300 POKE198,7:POKE631,76:POKE632,207:POKE633,159:POKE634,13
5400 POKE635,82:POKE636,213:POKE637,13
9000 DATA0,231,255,255,255,255,231,0
9010 DATA126,126,126,60,60,126,126,126
9020 DATA255,129,129,129,129,129,129,255
9030 DATA24,24,24,24,24,24,24,24
9040 DATA0,0,0,255,255,0,0,0
9050 DATA0,0,0,31,31,24,24,24
9060 DATA0,0,0,248,248,24,24,24
9070 DATA24,24,24,248,248,0,0,0
9080 DATA24,24,24,31,31,0,0,0
9090 DATA255,255,255,255,255,255,255,255
9100 DATA28,28,8,62,8,20,34,65,0
     READY.
```

hustler

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MAIN-PROGRAM NOTES

0	Set QWE to a random number using TI as a seed.
1	Clear all the variables from memory while leaving the program intact.
2	Prompt for easy or hard.
3	Validate the answer.
5	Clear the screen and set the sound volume to full; set the start of the character memory.
10	Set up the variables used in the game.
45	Border colour is yellow, background colour is white.
50	Fill the screen with user defined character 2.
80	Fill the screen colour memory with blue, thus making all the characters POKE into the memory blue.
96	Fill the screen memory with user-defined character 9.
97	Fill the screen colour memory with black.
98-99	Put men onto the screen in random positions, MAN is set to one in the first go.
100	Check the difficulty, if it is easy then don't put the random blocks onto the screen.
101-102	Put ten random blocks onto the screen and colour them.
103	Put character CH (Bike character 1 or 0) into the screen memory specified by A. At the start of the game this is 8174 which is line 22, 10 characters across (bottom centre). This is then coloured red and a trail is left behind it by subtracting the movement amount D from A. The trail is in WT (chars 3 to 8 depending on the direction). Note that this line is the beginning in the main loop.
104	Make the bike noise using a mixture of low medium and high range tones.
105	Remember the old direction/position before changing it. Saved in OD.
106	Check the trail.
107	Get new trail if not zero.
110	Get a key from the

MAIN PROGRAM

```
0 QWE=RND(1-TI)
1 CLR
2 PRINT"■■DO YOU WANT EASY(■1■) OR HARD (■2■)":INPUTTYU
3 IFTYU<1ORTYU>2THEN2
5 PRINT"■":POKE36878,15:POKE36869,255
10 A=8174:GRID=1:CH=1:DF=1:WT=3:NW=3:D=-22:SC=0:MAN=1
45 POKE36879,56
50 FORN=7680TO8185:POKEN,2:NEXT
80 FORN=38400TO38905:POKEN,6:NEXT
96 FORN=7680TO8164STEP22:POKEN,9:NEXT
97 FORN=38400TO38884STEP22:POKEN,0:NEXT
98 FORN=1TOMAN:RP=INT(RND(1)*506)+7680:IFPEEK(RP)<>2THENRP=RP+1
99 POKERP,10:NEXTN
100 IFTYU=1THEN103
101 FORN=1TO10:SP=INT(RND(1)*506)+7680:IFPEEK(SP)<>2THENSP=SP+1
102 POKESP,230:POKESP+30720,0:NEXT
103 POKEA,CH:POKEA+30720,2:POKEA+(-D),WT
104 POKE36874,196:POKE36875,196:POKE36876,176
105 OD=D
106 IFNW=0THEN110
107 WT=NW
110 GETA$
120 IFA$="Z"THEND=-1:WT=4:CH=0
130 IFA$="X"THEND=1:WT=4:CH=0
140 IFA$="L"THEND=-22:WT=3:CH=1
150 IFA$=","THEND=22:WT=3:CH=1
160 A=A+D
162 IFPEEK(A)<>2ANDPEEK(A)<10ORPEEK(A)=230THEN4000
163 IFPEEK(A)=10THENGOTO6100
165 GOTO3000
180 IFA<7680ORA>8185THENGOTO4000
190 GOTO103
3000 IFOD=-22ANDD=-1THENNW=4:WT=6
3010 IFOD=22ANDD=-1THENNW=4:WT=7
3020 IFOD=-22ANDD=1THENNW=4:WT=5
3030 IFOD=22ANDD=1THENNW=4:WT=8
3040 IFOD=1ANDD=22THENNW=3:WT=6
3050 IFOD=1ANDD=-22THENNW=3:WT=7
3060 IFOD=-1ANDD=-22THENNW=3:WT=8
3070 IFOD=-1ANDD=22THENNW=3:WT=5
3080 GOTO180
4000 POKE36874,0:POKE36875,0:POKE36876,0
4001 FORKN=1TO10
4002 QW=128
4010 FORN=0TO7
4020 POKE(A+-D)+30720,N
4030 POKE36877,QW
4035 QW=QW+5
4040 NEXT
4050 NEXT
4055 POKE36877,0
4060 FORMJ=1TO250:NEXT
4070 POKE36869,240
4080 PRINT"■■"
4090 POKE36879,8
4100 PRINT"     ■ GRID BIKE "
4110 PRINT"■■■■YOUR SCORE=";SC
4120 IFSC>HSTHENHS=SC
4130 PRINT"■HIGH SCORE=";HS
4140 PRINT"■■ANOTHER GAME(Y/N)"
4150 GETA$:IFA$=""THEN4150
4151 RESTORE
4160 IFA$="Y"THENGOTO4200
4170 IFA$="N"THENEND
4180 GOTO4150
4200 PRINT"DO YOU WANT (■1■)EASY OR (■2■)HARD
4210 INPUTTYU
4215 IFTYU<1ORTYU>2THEN4210
4220 PRINT"■":POKE36869,255:GOTO5
6100 DF=DF+1
6102 SC=SC+10
6105 IFDF<MANTHEN165
6110 PRINT"■":POKE36874,0:POKE36875,0:POKE36876,0
6120 PRINT"■■■■GRID";GRID;"CLEARED"
6125 FORRT=1TO2500:NEXT
6130 DF=0:MAN=MAN+1:GRID=GRID+1:SC=SC+100:A=8174:
     D=-22:WT=3:CH=1:NW=3:GOTO45
```

keyboard without waiting for it to be pressed.

120 'Z' is left, thus D is set to −1, the trail and the bike are set to their horizontal values.

130 'X' is right.

140 'L' is up and D is set to −22 (this is the amount added to A for the new position). CH is set to the vertical character.

150 ',' is down.

160 Update the screen position of the bike.

162 Check for a crash.

163 Check to see if a man has been picked up.

165 Jump to corner routines at 3000.

180 Check to see if the bike has gone off the screen, if so then end game.

190 Keep on going through the loop.

3000 Set characters for up to left, puts and angled corner character onto the screen.

3010 Down to left.

3020 Up to right.

3030 Down to right.

3040 Right to down.

3050 Right to up.

3060 Left to up.

3070 Left to down.

3080 Return to main routine.

4000 Turn off sounds.

4001-4050 When/if you've crashed, this routine flicks the bike character through all the colours ten times by POKEing the colour memory with the colours specified by N. This line also triggers the noise generator for a crash sound.

4055 Turn the noise off.

4060 Pause for a bit.

4070 Reset the character memory.

4080 Clear the screen and set the printing colour.

4090 Set the foreground and background colours.

4100-4140 Print score and prompt for another game.

4150 Scan keyboard for answer.

4151 Reset the data pointers.

4160-4180 Validate and act on the reply.

4200-4220 Prompt for and get the difficulty, then clear the screen and restart the game.

6100 Increment the number of men picked up.

6102 Increment the score by ten.

6105 Check whether all of the men have been picked up.

6110 Turn off all the sound.

6120 Tell the player that the grid has been cleared.

6125 Pause.

6130 Set up the variables for the next stage in the game.

Heli-bomber

Robert Erskine

If you're fed up with games that have you whizzing around, you'll find it refreshing to return to Earth and struggle to cope with a fleet of helicopters whose pilots are committed to wiping out your fair city by foul means.

Thankfully you're in control of the metropolitan laser tower, and it's up to you to shoot down the bombs before they hit the city. You'll get points for every bomb you hit, and while you can wipe out a chopper if you feel so inclined, you won't add to your tally by this kind of aggressive action.

You move your laser into sight with the Q, A, M and N keys. The game is over once one of the bombs finds a clear path to the ground or the laser tower itself is destroyed.

```
    0 HS=0:POKE650,128:REM AUTO REPEAT O
N ALL KEYS.
   10 IFPEEK(53272)=21THENGOSUB9000
   20 DIMSD%(24,21):SL$="■■■■■■■■■■■■■■■■
";c1$=""
   30 BD%=0:SC=0:HE=0:EN%=0:GOSUB20000
   40 POKE53280,0:POKE53281,0
   50 PRINT"■■■■■■■■■■  ■ DO YOU WANT INS
TRUCTIONS? (Y/N) "
   60 WAIT198,15:GETA$:IFA$="Y"THENGOTO6
3
   61 IFA$="N"THEN100
   62 GOTO60
   63 GOSUB10000
  100 GOSUB1000:GOSUB1150:GOSUB2270
  110 IFPEEK(198)>1THENPOKE198,1
  111 DX=0:DY=0:GETA$:GOSUB21000
  120 IFA$="Q"ORA$="●"THENDY=-1
  130 IFA$="A"ORA$="♠"THENDY=1
  140 IFA$="N"ORA$="/"THENDX=-1
  150 IFA$="M"ORA$="\"THENDX=1
  160 IFA$=" "ORA$=" "THENGOSUB1700
  170 GOSUB21000:GOSUB1200:GOSUB1300
  180 GOSUB21000:IFBD%=0ANDRND(1)>.85THE
NBD%=1:BX=HX:BY=HY+2
  190 IFBD%=1THENGOSUB1400:IFEN%=1THEN11
000
  200 PRINTLEFT$(SL$,18);SPC(19):PRINT"■ ●"
  998 GOSUB21000:GOSUB1600
  999 GOTO110
 1000 REM *** BUILD TOWN
 1010 PRINT"■";:FORN=0TO39
 1020 H=INT(RND(1)*5)+20
 1030 PRINTLEFT$(SL$,H);TAB(N);:PRINTMID
$(CL$,RND(1)*7+1,1);
 1040 FORX=HTO24
 1050 PRINTCHR$(165)"■";:NEXT:NEXT
 1100 REM *** BUILD LASER TOWER
 1110 PRINTLEFT$(SL$,18);TAB(19);"■●■";

 1120 FORX=1TO6:PRINT"×■";:NEXT
 1130 RETURN
 1150 REM *** INITIALISE SIGHT POSITION
 1160 SX=19:SY=10
 1200 REM *** PRINT SIGHT
 1202 PRINTLEFT$(SL$,SY+1);SPC(SX);" ";
 1210 SY=SY+DY:SX=SX+DX
 1211 IFSX>39THENSX=0
 1212 IFSX<0THENSX=39
 1213 IFSY<2THENSY=17
 1214 IFSY>17THENSY=2
 1230 PRINTLEFT$(SL$,SY+1);SPC(SX);"■+";:
RETURN
 1300 REM *** MOVE HELICOPTER
 1310 PRINTLEFT$(SL$,HY+1);SPC(HX-1);"
   "
 1320 HX=HX+INT(RND(1)*2)+1:IFHX>37THENH
```

```
X=1
 1330 HY=HY+INT(RND(1)*3)-1:IFHY>15THENH
Y=15
 1340 IFHY<2THENHY=2
 1350 PRINTLEFT$(SL$,HY+1);SPC(HX);"
";:FORQQ=1TO3
 1351 PRINTCHR$(160+QQ);:NEXT
 1360 RETURN
 1400 REM *** BOMB ON WAY !
 1410 PRINTLEFT$(SL$,BY+1);SPC(BX);" "
 1420 P=PEEK(1064+BX+(40*BY)):IFP<>32AND
P<>43THEN1450
 1430 BY=BY+1:IFBY>23THENEN%=1:RETURN
 1440 PRINTLEFT$(SL$,BY+1);SPC(BX);"
";C
HR$(164);
 1441 POKE54284,241:POKE54283,17:POKE542
80,(30-BY)*8:RETURN
 1450 REM *** BOMB HIT SOMETHING !
 1451 POKE54296,0:POKE5428З,0
 1460 IFP=81THENEN%=1
 1470 FORM=15TO0STEP-1:PRINTLEFT$(SL$,BY
+2);SPC(BX);CHR$(164);
 1480 PRINTLEFT$(SL$,BY+2);SPC(BX);" ";
 1481 POKE54296,M:POKE54284,15:POKE54280
,40:POKE54279,200:POKE54283,129:NEXT
 1490 BD%=0:POKE54283,0:RETURN
 1600 REM *** UPDATE SCORE LINE
 1610 PRINT"
 SCORE =";SC;" HELICOPTER
S DESTROYED =";HE
 1620 RETURN
 1700 Y=18-SY:X=SX-19
 1701 FORV=15TO0STEP-1.5
 1702 POKE54296,V:POKE54284,15:POKE54280
,40:POKE54279,200:POKE54283,129:NEXT
 1703 POKE54283,0
 1710 IFX=0THEN1800
 1720 M=Y/X:FORY=16TO3STEP-1:HY%=Y
 1730 HX%=19+((18-HY%)/M):GOSUB2000
 1735 IFHX%<10RHX%>39THENY=2:GOTO1760
 1740 PRINTLEFT$(SL$,HY%+1);SPC(HX%);"
";
 1750 PRINTLEFT$(SL$,HY%+1);SPC(HX%);" "
;
 1760 NEXT:POKE198,0:RETURN
 1800 HX%=19:FORY=16TO3STEP-1:HY%=Y:GOSU
B2000:GOTO1740
 2000 REM *** HIT SOMETHING?
 2010 XY=PEEK(1024+HX%+(40*HY%))
 2020 IFXY=32ORXY=43THENRETURN
 2030 IFXY=97ORXY=98ORXY=99THEN2100
 2040 FORV=10TO1STEP-1:PRINTLEFT$(SL$,BY
+1);SPC(BX);"*
 ";:GOSUB22000:NEXT
 2070 SC=SC+10:GOSUB1600:BD%=0:RETURN
 2100 REM *** HIT HELICOPTER
 2101 POKE54276,0:POKE54277,0:POKE54272,
0
 2102 POKE54276,33
 2120 PRINTLEFT$(SL$,HY+1);SPC(HX-1);"
 "
 2130 P=1023+HX+(40*(HY+2)):IFPEEK(P)<>3
2ANDPEEK(P)<>100ANDPEEK(P)<>43THEN2200
 2131 IFPEEK(P+1)<>32ANDPEEK(P+1)<>100AN
DPEEK(P+1)<>43THEN2200
 2132 IFPEEK(P+2)<>32ANDPEEK(P+2)<>100AN
DPEEK(P+2)<>43THEN2200
 2140 HY=HY+1:PRINTLEFT$(SL$,HY+1);SPC(H
X);"
"
 2150 PRINTSPC(HX-1);"
";:POKE54277,25
5:POKE54273,(30-HY)*8:GOTO2120
 2200 HE=HE+1
 2210 FORV=15TO0STEP-.5:GOSUB22000
 2220 PRINTLEFT$(SL$,HY+2);SPC(HX-1);"
***"
 2225 PRINTLEFT$(SL$,HY+2);SPC(HX-1);"
!/"
 2230 NEXT:PRINTLEFT$(SL$,HY+2);SPC(HX-1
);"
";:POKE54283,0
 2240 PRINTLEFT$(SL$,HY+3);SPC(HX-1);"
";:GOSUB1600
 2270 HX=0:HY=INT(RND(1)*15)+2:GOTO1320
 9000 PRINT"
 SETTING UP GRA
PHICS - PLEASE WAIT.
"
 9001 POKE56,48:POKE52,48:POKE1,55
 9002 GOSUB9500
 9003 Q=0:RESTORE
 9004 READA:IFA=-1THENRETURN
 9005 POKE13064+Q,A:Q=Q+1:GOTO9004
 9010 DATA0,192,112,63,15,3,0,0,1,31,60,
254,255,255,8,127
 9011 DATA128,240,136,108,252,248,34,252
,60,60,24,60,60,60,60,24
 9012 DATA255,153,255,153,255,153,255,15
3
 9499 DATA-1
 9500 CS=12288
 9510 POKE56334,PEEK(56334)AND254
 9520 POKE1,PEEK(1)AND251
 9530 FORI=CSTOCS+2047
 9540 POKEI,PEEK(53248+I-CS)
 9550 NEXTI
 9560 POKE1,PEEK(1)OR4
 9570 POKE56334,PEEK(56334)OR1
 9580 POKE53272,(PEEK(53272)AND240)+12
 9590 RETURN
10000 REM INSTRUCTIONS
10010 PRINT"
 H E L I - B O M B E
R S !
"
10020 PRINT"   YOUR CITY IS BEING ATTACK
ED BY       HELICOPTER BOMBERS.
10030 PRINT"WHEN A BOMB HAS A CLEAR PATH
 THROUGH TO THE GROUND, OR WHEN YOUR";
10040 PRINT"LASER TOWER IS  DESTROYED, T
HE GAME ENDS."
10050 PRINT"MOVE YOUR LASER SIGHT USING
'Q' TO GO UP'A' TO GO DOWN, 'M' TO GO";
10060 PRINT" RIGHT AND 'N' TO GO LEFT. T
O FIRE YOUR LASER, PRESS"
10065 PRINT"THE SPACE BAR."
10070 PRINT"THE OBJECT OF THE GAME IS TO
 PROTECT THECITY BY SHOOTING DOWN THE";
10080 PRINT" BOMBS BEFORE  THEY REACH TH
E BUILDINGS."
10090 PRINT"
 PRESS ANY KEY TO S
TART. "
10091 WAIT198,51:GETA$:RETURN
11000 REM END OF GAME...
11010 PRINT"
 G A M E   O V
E R !
"
11020 PRINT"   A BOMB HAS PENETRATED YOU
R DEFENSES."
11030 PRINT"YOU DESTROYED "HE" HELICOPTE
RS, AND"
11040 PRINT"SCORED "SC" POINTS.
"
11050 IFSC<=HSTHEN11080
11060 PRINT"
 THAT'S A NEW HIGH SC
ORE! "
11070 PRINT"THE OLD HIGH SCORE WAS "HS"
POINTS.":HS=SC
11080 PRINTSL$"
 DO YOU WANT TO PLAY
 AGAIN? (Y/N)";
11090 WAIT198,15:GETA$:IFA$="N"THENPOKE5
4296,0:END
11095 IFA$<>"Y"THEN11090
11096 GOTO30
20000 FORM=1TO10
20009 PRINT"
":FORN=1TO8:PRINTMID$(CL$
,N,1);"
 H E L I - B O M B E R S !"
20010 NEXT:POKE53280,RND(1)*255:POKE5328
```

```
1,RND(1)*255:NEXT
20020 RETURN
21000 REM HELECOPTER SOUND
21001 POKE54276,0:POKE54277,0:POKE54272,
0
21002 POKE54276,129
21010 POKE54296,15:POKE54277,64
21020 POKE54273,10:POKE54272,255:POKE542
76,33:RETURN
22000 POKE54283,0
22001 POKE54296,V:POKE54284,15:POKE54280
,40:POKE54279,200:POKE54283,129
22002 RETURN
```

Battlestar Fighter

by G & B Rushby

If, as an expert computer user, you have ever wanted to learn how to fly a star fighter, this simulator is what you have been looking for.

The game uses joystick port two to control the fighter, but can easily be converted to run from the keyboard (see the accompanying notes). Notice that you are controlling your fighter and not the alien's. So, if the alien is above you, pull the stick back, if the alien is to your right then push the stick to the right to line yourself up so you can 'blast the alien out of the sky'.

The program makes good use of the 64's sprite facilities, to define the alien space craft that you're after. You have to hit the alien five times to kill it and it needs to be in the centre of your sights to hit it at all.

10-19	Copyright message
20	Set the screen and border colours then go to title page.
50	Set the sound register base at 54272.
60	Dimension the arrays used in the high score table.
100-105	Set sprite registers and define text as priority.
120-135	Declare all variables.
140-150	If G=0 then load the sprite data. If G=1 then no need to do it again.
160-171	Instructions option of first game. Subsequent games ignore this instructions option.
175	G=1, therefore preliminaries not needed again. Set the screen and border colours.
190	Gosub to screen print routine, then go to general initialisation and main routine loop.
200-20	Move left routine, includes part of the main sound routine at line 201.
203-204	Move the sprite left and test if the coordinates are allowed.
205-230	Deletes old radar image.
240-242	Move right routine. Includes part of the main sound routine at line 241.
243-244	Move the sprite right and test if the coordinates are allowed.
248-260	Delete the old radar image — POKE new radar image.

```
10 REM ********************************
12 REM
13 REM         BATTLESTAR FIGHTER
14 REM
15 REM WRITTEN BY BRIAN AND GARY RUSHBY
16 REM
17 REM           DECEMBER 1983
18 REM
19 REM ********************************
20 POKE53280,12:POKE53281,12:GOSUB2500
50 REM ** SOUND REGISTER **************
51 SD=54272
60 DIMSC$(5),SC(5),SH(5):FORJ=1TO5:SC$(J)="**********"
   :SC(J)=0:SH(J)=0:NEXTJ
100 REM** SET SPRITE REGISTERS ********
101 V=53248:POKEV+40,6:POKEV+44,6:POKEV+45,6:POKEV+46,2
   POKE53275,255
105 POKE2045,244:POKE2046,245:POKE2047,246
120 REM ** DECLARATION OF VARIABLES ***
125 G=0:HI=0
130 SC=0:X=0:Y=0:I=0:SI=0:XP=0:XE=0:XR=0:XD=0:N=0:JY=0:M=0:Q=0
    S=0:TI$="000000"
135 YR=0:CL=0:F=500:A=0:SH=0
140 IF G=1 THEN GOTO 190
150 IFG=0 THEN GOSUB 5000
160 REM **INSTRUCTIONS OPTION**********
161 IFG=0 THENPRINT"[redacted]
    DO YOU REQUIRE INSTRUCTIONS(Y/N)"
167 GETA$:IFA$=""THEN 167
169 IFA$<>"Y" AND A$<>"N" THEN 167
171 IFA$="Y"THEN GOSUB 3000
175 G=1:POKE53280,11:POKE53281,12
190 GOSUB 1000:GOTO 700
200 REM ** MOVE LEFT ******************
201 POKESD+4,19
203 X=X-6:IFX=<0 AND SI=2 THEN X=X+255:POKEV+16,0:POKEV+2,X:SI=0
204 IFX=<0 AND SI=0 THEN X=0
205 IFXP=<0 THEN XP=0
207 POKEXD+(YR-1)*40,160:POKEXD+54272+(YR-1)*40,5
211 XE=XP:XP=XP-6:IFXP<0 THEN XP=0
212 XR=1558+INT(XE*12/347)
218 POKEXR+YR*40,160:POKEXR+54272+YR*40,5
220 XD=1558+INT(XP*12/347)
225 POKEXD+YR*40,87:POKEXD+54272+YR*40,6
230 RETURN
240 REM ** MOVE RIGHT *****************
241 POKESD+4,19
243 X=X+6:IFX=>256 AND SI=0 THEN X=X-256:POKEV+16,2:POKEV+2,X:SI=2
244 IFX>90 AND SI=2 THEN X=90
248 POKEXD+(YR-1)*40,160:POKEXD+54272+(YR-1)*40,5
250 XE=XP:XP=XP+6:IF XP>347 THEN XP=347
252 XR=1558+INT(XE*12/347)
254 POKEXR+YR*40,160:POKEXR+54272+YR*40,5
255 XD=1558+INT(XP*12/347)
```

270-276	Move up routine. Includes part of the main sound routine in line 271.
280-290	Move down routine. Includes part of the main sound routine at line 281.
295-315	Tests if alien is within fire range, if so then calculate the new score and the number of times the alien has been hit. Print the new score.
320-335	Calculates and prints the amount of fuel left. Also includes part of the main sound routine at line 325.
340-400	Explode the alien routine: sequentially explodes alien with four explode sprites plus final sprite expanded. Includes the sound routine for the explosion. Also deletes the radar image.
500-699	Laser routine, prints the laser beams onto the screen and then deletes them. A sound routine is included between the prints and deletes. Line 665 detects if the alien sprite is within the limits of the sights.
700-900	Main routine loop, 775 prints the position of the alien on screen. The size of ther alien (distance away) is defined by N. 776 tuns sprites 0 (sights) and 1 (alien) and also tells the sprite which side of the screen to appear.
780-805	Joystick routines. If the keyboard is to be used then include the following lines:
780	GETA$
785	IF A$="U" THEN GOSUB 270

```
258 POKEXD+YR*40,87:POKEXD+54272+YR*40,6
260 RETURN
270 REM ** MOVE UP ********************
271 POKESD+4,19
275 Y=Y-6:IFY<0 THEN Y=0
276 RETURN
280 REM ** MOVE DOWN ******************
281 POKESD+4,19
285 Y=Y+6:IFY>150 THEN Y=150
290 RETURN
295 REM** SCORE ROUTINE ***************
300 IF YR>2 THEN SC=SC+10:A=A+1
305 IF A=5 THEN SC=SC+100
310 PRINT"████████████████████████████████████████████████"
    ;SC
315 RETURN
320 REM ** PRINT FUEL *****************
325 POKESD+4,18
327 F=INT(F-CL/50)
330 PRINT"█████████████████████     █████";F
335 RETURN
340 REM ** EXPLODE ROUTINE ************
345 POKEV+21,1:POKEXD+YR*40,160:POKEXD+54272+YR*40,5
350 FORI=0TO7:POKEXD+I*40,160:POKEXD+54272+I*40,5:NEXT
355 POKE1985+SH,87:POKE56257+SH,2:SH=SH+1
357 POKESD+1,6:POKESD+24,15:POKESD+4,129
360 POKEV+10,176:POKEV+11,79:POKEV+21,33:FORI=6TO15STEP.
    3:POKESD+24,I:NEXT
365 POKEV+14,176:POKEV+15,79:POKEV+21,129:FORI=0TO40:NEXT
370 POKEV+12,176:POKEV+13,79:POKEV+21,193:FORI=0TO40:NEXT
375 POKEV+14,164:POKEV+15,69:POKEV+29,128:POKEV+23,128
378 FORI=15TO0STEP-.15:POKESD+24,I:NEXT
379 FORI=0TO5:NEXT
380 POKESD+24,0:POKEV+21,1:POKEV+29,0:POKEV+23,0:A=0
400 RETURN
500 REM ** LASER ROUTINE **************
505 PRINT"███████████"
507 POKESD+4,129:POKESD+5,15:POKESD+1,40:POKESD,200
510 PRINT"████████████████L╱╱██████████╲╲"
512 POKESD+24,2
520 PRINT"██████████████████L╱╱████████╲╲"
522 POKESD+24,5
530 PRINT"███████████████████L╱╱██████╲╲"
532 POKESD+24,9
540 PRINT"████████████████████L╱╱████╲╲"
542 POKESD+24,13
550 PRINT"█████████████████████L╱╱██╲╲"
552 POKESD+24,15
560 PRINT"██████████████████████L╱╳╲"
600 PRINT"███████████"
610 PRINT"████████████████  ██████████  "
612 POKESD+24,15
620 PRINT"██████████████████  ████████  "
622 POKESD+24,13
630 PRINT"███████████████████  ██████  "
632 POKESD+24,9
640 PRINT"████████████████████  ████  "
642 POKESD+24,5
650 PRINT"█████████████████████  ██  "
652 POKESD+24,0
660 PRINT"██████████████████████    "
665 IFX>173 ANDX <185 AND Y >75 AND Y<83 THEN GOSUB 295
699 RETURN
700 REM ** GEN INITIALISATION *********
705 F=500:A=0
710 YR=0:TI$="000000":N=0
715 X=INT(348*RND(1)):XE=X:XP=X
720 IF X=<255 THEN SI=0
725 IF X>255 THEN X=X-256:SI=2
730 Y=INT(150*RND(1))
735 XR=1558+INT(XE*12/347)
745 POKEXR,160:POKEXR+54272,5
750 XD=1558+INT(XP*12/347)
760 POKEXD,87:POKEXD+54272,6
770 REM ** MAIN ROUTINE ***************
775 POKE2041,241+N:POKEV+2,X:POKEV+3,Y
776 POKEV+21,3:POKEV+16,SI
780 JY=NOTPEEK(56320)AND15
785 IFJYAND1THENGOSUB270
790 IFJYAND2THENGOSUB280
795 IFJYAND4THENGOSUB240
800 IFJYAND8THENGOSUB200
805 IFNOTPEEK(56320)AND16THENGOSUB500
810 IFA=5 THEN GOSUB 340:GOTO 710
811 POKESD+1,100:POKESD+5,219:POKESD+15,28:POKESD+24,15:POKES+4,19
815 CL=VAL(RIGHT$(TI$,2))
820 GOSUB 320:IF F<1 THEN GOTO 1500
```

```
 825 IFCL/4=INT(CL/4) THEN N=INT(CL/4):YR=N
 830 IF N>3 THEN N=3
 835 IF YR<8 THEN GOTO 850
 840 POKEV+21,1:POKEXD+280,160:POKEXD+54272+280,5
 845 FORI=1TO2000:NEXT:A=0:GOTO 710
 850 REM ** RANDOM MOVEMENT ***********
 851 M=INT(RND(1)*4)+1
855 ON M GOSUB 200,240,270,280
900 GOTO 770
1000 REM ** SCREEN PRINT **************
1005 PRINT"
1010 PRINT"
1020 PRINT"
1030 PRINT"
1040 PRINT"
1050 PRINT"
1060 PRINT"
1070 PRINT"
1080 PRINT"
1090 PRINT"
1100 PRINT"
1110 PRINT"
1120 PRINT"
1130 PRINT"
1140 PRINT"
1150 PRINT"
1160 PRINT"  FUEL
1170 PRINT"  500
1180 PRINT"
1190 PRINT"
1200 PRINT"
1210 PRINT"
1220 PRINT"
1230 PRINT"
1240 PRINT"
1250 POKE2023,160:POKE56295,9
1260 POKE2040,240:POKEV+39,1:POKEV,176:POKEV+1,79:POKEV+21,1
1300 RETURN
1500 REM** END OF GAME ***************
1505 POKEV+21,0:FORL=0 TO 24:POKESD+L,0:NEXT
1510 POKESD+14,5:POKESD+18,16:POKESD+3,1:POKESD+24,143:POKESD+6,240:POKESD+4,65
1515 FR=5389
1520 FORI=0TO70 : POKE53265,PEEK(53265)AND239
1525 FQ=FR+PEEK(SD+27)*3.5 : HF=INT(FQ/256):LF=FQ-HF*256
1530 POKESD,LF:POKESD+1,HF
1535 POKE53265,PEEK(53265)OR16
1540 NEXTI
1545 POKESD+24,0
2000 PRINT"
2002 PRINT"YOU SCORED ";SC "POINTS"
2003 PRINT:PRINT"YOU DESTROYED ";SH "ALIEN SHIPS"
2025 IF HI<SC THEN HI=SC:PRINT"  A NEW HI-SCORE
2030 PRINT"HI-SCORE= ";HI
2100 FORX=0TO20:GETA$:NEXTX : Z=0:FORX=1TO5:IFSC>SC(X)THENZ=X:X=11
2105 NEXTX:IFZ=0THEN2140
2110 PRINT"ENTER YOUR NAME:"
2115 INPUT A$:IF LEN(A$)>10THENA$=LEFT$(A$,10)
2120 IF Z=5 THEN2130
2125 FORX=4TOZ STEP-1:SC(X+1)=SC(X):SC$(X+1)=SC$(X):SH(X+1)=SH(X):NEXTX
2130 SC(Z)=SC:SC$(Z)=A$:SH(Z)=SH
2140 PRINT"HIGH SCORE TABLE"
2150 PRINT"
2151 PRINT" "TAB(5);"SCORE";TAB(13);"SH"
2152 PRINTTAB(5);"";TAB(13);"
2155 FORX=1TO5:PRINT" ";X;TAB(5);SC(X);TAB(12);SH(X);TAB(18);SC$(X)
2160 NEXTX:X=FRE(0)
2240 PRINT:PRINT"DO YOU WANT ANOTHER GO"
2250 GET A$:IF A$=""THEN 2250
2260 IF A$="Y" THEN PRINT"":GOTO 130
2270 IF A$="N" THEN PRINT"BYE":END
2280 IF A$<>"Y" AND A$<>"N" THEN 2250
2500 REM ** TITLE PAGE ***************
2501 PRINT"
2505 PRINT"****************************************"
2510 PRINT"
2515 PRINT"
2520 PRINT"
2525 PRINT"
2530 PRINT:PRINT
2535 PRINT"
2540 PRINT"
2545 PRINT"
2550 PRINT"
2555 PRINT:PRINT
2560 PRINT"          WRITTEN BY
2561 PRINT
2565 PRINT"       BRIAN AND GARY RUSHBY
2566 PRINT
2573 PRINT:PRINT
```

790	IF A$="D" THEN GOSUB 280
795	IF A$="R" THEN GOSUB 240
800	IF A$="L" THEN GOSUB 200
805	IF A$="F" THEN GOSUB 500
	The keys UDRLF can be any convenient control keys.
810	Detects if 5 hits an alien.
811	Main sound routine.
815	Value of CL depends on the clock (CL is used to determine how far away the alien is and also how much fuel is left).
820	Determines the size of the alien and also the distance away for the radar image.
830	Allows only 4 sizes of alien (0-3).
835	Detects if the alien has gone past.
840	Turns off alien and radar image.
845	Delay loop and initialisation for next alien.
850-855	Random movement of alien.
1000-1250	Print the cockpit.
1260	Print sprite for sights.
1500-1540	End of game sequence. Turns off all sprites and initialises siren sound routine.
1545	Turn off sound.
2000-2030	Print the final score and high score.
2100-2105	Empty the keyboard buffer, find position of last score in the high score table.
2110-2155	Print the new high score table.
2160	PRE(0) prevents garbage collection.
2240-2280	Another game option.
2500-2999	Title page.
3000-3999	Instructions.
4999-5007	Enter sprite data into memory.
6000-7000	Sprite data.

```
2580 PRINT"▓▓PLEASE WAIT"
2999 RETURN
3000 REM ** INSTRUCTIONS **************
3001 PRINT"▓"
3004 PRINTCHR$(14):REM SWITCH TO LOWER CASE
3005 PRINT"▓▓▓▓▓▓▓   ** |♠||L‾♥|♠_ _\| ||‾_ ** "
3020 PRINT"****************************************"
3021 PRINT
3022 PRINT"▓    IOUR MOTHERSHIP BATTLESTAR IS UNDER"
3025 PRINT" ATTACK FROM ALIEN SPACESHIPS AND YOU"
3030 PRINT" HAVE BEEN SENT ON A SUICIDE MISSION"
3032 PRINT" TO PREVENT THEM GETTING THROUGH."
3033 PRINT
3034 PRINT"    IHE PRESENCE AND POSITION OF AN"
3035 PRINT" ALIEN SHIP CAN BE DETECTED ON YOUR"
3040 PRINT" ONBOARD RADAR SCREEN.IHIS WILL ALSO"
3045 PRINT" SHOW WHEN THE ALIEN SHIP IS WITHIN"
3050 PRINT" RANGE OF YOUR FIRE-POWER."
3052 PRINT
3055 PRINT"    IOU GAIN POINTS FOR EACH DIRECT HIT"
3060 PRINT" BUT TO DESTROY THE ALIEN YOU MUST HIT"
3065 PRINT" IT 5 TIMES.IHIS GIVES BONUS POINTS AND";
3070 PRINT"  CONFIRMATION OF DESTRUCTION IS SHOWN"
3075 PRINT" ON YOUR CONTROL PANEL."
3078 PRINT
3080 PRINT"▓▓PRESS ANY KEY TO CONTINUE▓"
3082 GETA$:IFA$="" THEN 3082
3085 PRINT"▓▓▓▓▓▓▓   ** |♠||L‾♥|♠_ _\| ||‾_ ** "
3090 PRINT"****************************************"
3091 PRINT
3092 PRINT"▓   ‾ONTROL OF YOUR FIGHTER IS BY"
3093 PRINT" JOYSTICK BUT REMEMBER THAT YOU ARE"
3095 PRINT" CONTROLLING THE FIGHTER AND THEREFORE "
3100 PRINT" MOVEMENT OF THE ALIEN SHIP IS RELATIVE"
3105 PRINT" (E.G IF YOU MOVE THE JOYSTICK RIGHT"
3110 PRINT" THEN YOUR FIGHTER MOVES RIGHT AND THE"
3115 PRINT" ALIEN MOVES LEFT.)"
3120 PRINT
3125 PRINT" |‾‾ L‾/ :-    IOUR MOTHERSHIP IS "
3130 PRINT" DEPENDING ON YOU TO DESTROY OR WEAKEN"
3135 PRINT" AS MANY ALIENS AS POSSIBLE.HOWEVER"
3140 PRINT" YOU ONLY HAVE A LIMITED AMOUNT OF FUEL"
3145 PRINT" WHEN THIS RUNS OUT YOUR MISSION IS"
3146 PRINT" TERMINATED."
3150 PRINT"▓▓▓▓▓PRESS ANY KEY TO START"
3155 GETA$: IFA$="" THEN 3155
3160 PRINTCHR$(142):REM SWITCH TO UPPER CASE
3999 RETURN
4999 REM ** ENTER SPRITE DATA *********
5000 FOR S=15360TO15422:READQ:POKES,Q:NEXT
5001 FOR S=15424TO15486:READQ:POKES,Q:NEXT
5002 FOR S=15488TO15550:READQ:POKES,Q:NEXT
5003 FOR S=15552TO15614:READQ:POKES,Q:NEXT
5004 FOR S=15616TO15678:READQ:POKES,Q:NEXT
5005 FOR S=15680TO15742:READQ:POKES,Q:NEXT
5006 FOR S=15744TO15806:READQ:POKES,Q:NEXT
5007 FOR S=15808TO15870:READQ:POKES,Q:NEXT

6000 REM ** DATA FOR SIGHTS ***********
6003 DATA136,0,17,80,0,10,32,0,4,64,0,2,128,0,1,0,0,0,0,0,0,0,24,0,0,66,0,0
6004 DATA0,0,168,153,21,0,0,0,0,66,0,0,24,0,0,0,0,0,0,0,128,0,1,64,0,2,32,0
6005 DATA4,80,0,10,136,0,17
6010 REM ** DATA FOR SMALL SHIP *******
6013 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,32,64,0,79,32,0,134,16,0
6014 DATA255,240,0,150,144,0,64,32,0,32,64,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
6015 DATA0,0,0,0
6020 REM ** DATA FOR SMALL-MED SHIP ***
6023 DATA0,0,0,0,0,0,0,0,9,242,0,24,163,0,56,67,128,112,225,192,161,80,160
6024 DATA159,95,32,159,95,32,160,160,160,112,65,192,56,3,128,24,3,0,8,2,0,0,0
6025 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
6030 REM ** DATA FOR MED-LARGE SHIP ***
6033 DATA0,0,0,0,0,0,0,0,4,0,128,12,252,192,28,72,224,56,48,112,112,120,56
6034 DATA160,180,20,159,183,228,160,180,20,159,183,228,162,73,20,114,49,56,56
6035 DATA0,112,28,0,224,12,0,192,4,0,128,0,0,0,0,0,0,0,0
6040 REM ** DATA FOR LARGE SHIP *******
6043 DATA0,0,0,2,0,64,6,0,96,14,126,112,30,36,120,60,24,60,120,126,30,144,153
6044 DATA9,159,153,249,160,153,5,160,153,5,159,153,249,145,90,137,121,36,158
6045 DATA60,24,60,30,0,120,14,0,112,6,0,96,2,0,64,0,0,0,0,0,0
6099 REM** DATA FOR EXPLOSION SPRITES *
6100 DATA144,0,0,36,32,132,15,3,198,30,9,224,61,17,242,120,112,120,240,168,60
6101 DATA175,39,196,161,36,68,161,36,68,175,39,196,248,168,125,60,114,136,30,1
6102 DATA177,79,10,232,7,115,192,3,2,128,0,32,16,2,0,0,0,4,2,96,97,4
6110 DATA144,0,0,36,39,132,136,3,192,24,9,128,61,17,242,26,112,0,240,168,60,169
6111 DATA39,4,32,0,64,161,36,68,35,36,196,120,168,125,0,114,136,30,1,170,79,10
6112 DATA0,7,115,195,3,2,128,3,160,16,2,0,0,0,4,2,96,97,4
6120 DATA144,0,72,36,32,4,136,2,16,24,9,128,5,17,242,26,112,0,242,40,60,169,32
6121 DATA4,32,0,64,161,36,68,35,36,196,64,168,125,0,18,136,30,1,177,67,10,0,6
6122 DATA19,192,36,2,128,192,160,16,2,0,0,0,4,2,96,97,4
7000 RETURN
```

Bridge Builder

The aim of this game is to build a bridge across the top of the ravine. This is achieved by building a series of beams vertically and horizontally.

This cursor can be moved up or down — but not diagonally — using a joystick plugged into port 1. The game is made more difficult by an inspector (the man in black) who checks to make sure the bridge is built correctly.

The beams must always start below the inspector, and after every beam has been built the inspector moves to a different position. The horizontal beams must be supported at both ends, either by the ground or by other beams.

The aim is to build a bridge in as few days as possible.

```
0
100 GRAPHICS 0
105 POSITION 13,0:? "BRIDGE BUILDER"
110 POKE 752,1:OPEN #2,4,0,"K:"
115 ? :?
120 ? " YOU ARE NOW AN OFFICIAL ENGINEER'":?
125 ? "  YOUR MISSION IS TO BUILD A BRIDGE"
130 ? "CONNECTING THE TWO BLOCKS AT THE TOP"
135 ? "OF THE SCREEN.  YOU DO SO BY PLACING"
140 ? "BEAMS ALONG THE INSPECTOR'S FEET."
145 ? "SIMPLY MOVE THE POINTER TO THE PLACE"
150 ? "WHERE YOU WISH TO PLACE A BEAM, THEN"
155 ? "ENTER THE DIRECTION YOU WISH TO SET"
160 ? "THE BEAM. TRY TO CONSTRUCT THE BRIDGE"
165 ? "IN AS FEW BAYS AS POSSIBLE."
170 ? :? :? "       PRESS RED BUTTON TO START"
175 IF STRIG(0)<>1 THEN 185
180 GOTO 175
185 GRAPHICS 5:SETCOLOR 2,0,0
190 POKE 752,1:SETCOLOR 1,11,10
195 SETCOLOR 0,15,2:SETCOLOR 4,0,4
200 COLOR 1
205 FOR X=0 TO 79:PLOT X,39:NEXT X
210 PLOT 0,8:DRAWTO 5,8
215 PLOT 0,9:DRAWTO 5,9
220 PLOT 79,8:DRAWTO 74,8
225 PLOT 79,9:DRAWTO 74,9
230 Y=10:D=71:X=4
235 PLOT 0,Y:DRAWTO X+3,Y
240 PLOT 79,Y:DRAWTO X+D-3,Y
245 Y=Y+1
250 IF INT(RND(0)*10)>3 THEN X=X+1:D=D-2
255 IF Y=39 THEN 265
260 GOTO 235
265 X=29+INT(RND(0)*17):Y=38
270 GOSUB 915
275 M=INT(RND(0)*31)+25:N=0
280 LOCATE M,N+1,XX
285 IF XX<>0 THEN 295
290 N=N+1:GOTO 280
295 N=N-10:IF N<0 THEN N=0
300 ? :? :? :? :?
305 ? "USE JOYSTICK TO MOVE BEAM POINTER..."
310 ? "      DAY N "|DA+1|" OF CONSTRUCTION"
315 IF M>76 THEN M=76
320 COLOR 2:PLOT M,N
325 FOR XX=1 TO 20:NEXT XX
330 C=STICK(0): IF C=15 THEN 325
335 IF C=7 THEN 360
340 IF C=11 THEN 380
345 IF C=13 THEN 400
350 IF C=14 THEN 418
355 GOTO 315
360 LOCATE M+1,N,XX
365 IF XX<>0 THEN 435
370 COLOR XX:PLOT M,N
375 M=M+1:COLOR 1:GOTO 315
380 LOCATE M-1,N,XX
385 IF XX<>0 THEN 435
390 COLOR XX:PLOT M,N
395 M=M-1:COLOR 1:GOTO 315
400 LOCATE M,N+1,XX
405 IF XX<>0 THEN 435
410 COLOR XX:PLOT M,N
415 N=N+1:COLOR 1:GOTO 315
418 IF N<>0 THEN LOCATE M,N-1,XX
419 IF XX<>0 THEN 435
420 COLOR 0:PLOT M,N
425 N=N-1:IF N<1 THEN N=1
430 COLOR 2:GOTO 315
435 IF XX=3 THEN 330
437 IF N<Y THEN ? :? :?"STICK MUST START BELOW
    INSPECTOR'":COLOR 0:PLOT M,N:CO
LOR 1
440 IF N<Y THEN FOR I=1 TO 200:SOUND 0,36,36,
    36:NEXT I:SOUND 0,0,0,0:GOTO 300
445 ? :?
446 ? "       PRESS BUTTON TO BUILD HERE":?
    :FOR DELAY=1 TO 100:NEXT DELAY:POKE 7
7,0
447 IF STRIG(0)=0 THEN 450
448 IF STICK(0)<>15 THEN 300
449 GOTO 447
450 ? :?
452 ? "       USE JOYSTICK TO SET BEAM"
455 ? "         IN EITHER DIRECTION"
460 REM
465 D=0:C=STICK(0)
470 IF C=15 THEN 465
475 IF C=14 THEN D=1
480 IF C=11 THEN D=2
485 IF C=7 THEN D=3
490 IF D<1 OR D>3 THEN 465
495 DA=DA+1:M1=M:N1=N
500 QQ=0
505 FOR I=1 TO 10
510 QQ=QQ+1
515 SOUND 0,100,60,100
520 FOR XX=1 TO 10:NEXT XX
525 SOUND 0,0,0,0
530 IF M>76 OR N>6 OR M<2 THEN 585
535 COLOR 2:PLOT M,N
537 ON D GOTO 538,539,540,541
538 LOCATE M,N-1,XX:GOTO 545
539 LOCATE M-1,N,XX:GOTO 545
540 LOCATE M+1,N,XX:GOTO 545
541 LOCATE M+1,N,XX
545 IF XX=0 THEN 550
546 I=18:GOTO 555
550 I=I+INT(RND(0)*3)-1
555 ON D GOTO 560,565,570,575
560 N=N-1:GOTO 580
565 M=M-1:GOTO 580
570 M=M+1:GOTO 580
575 N=N+1
580 NEXT I
585 LOCATE M,N+1,XX
590 IF XX<>0 AND XX<>3 OR D=1 THEN 695
595 M=M1:N=N1
600 ? :?
605 ? "BOTH ENDS OF BEAM MUST BE SUPPORTED'"
610 FOR I=1 TO 200:SOUND 0,36,36,36
615 NEXT I:SOUND 0,0,0,0
620 REM
625 FOR I=1 TO 60:COLOR 0
630 PLOT M,N
635 SOUND 0,100,60,100
640 FOR XX=1 TO 10:NEXT XX
645 SOUND 0,0,0,0
650 ON D GOTO 655,660,665,670
655 N=N-1:GOTO 675
660 M=M-1:GOTO 675
665 M=M+1:GOTO 675
670 N=N+1
675 IF N<2 THEN 685
680 NEXT I
685 REM
690 GOTO 275
695 SOUND 0,0,0,0
700 W=0:IF X<M THEN W=1
705 ? "       INSPECTION...":? :?
710 FOR I=1 TO INT(RND(0)*40)+10
715 SOUND 0,60,6,10:SOUND 0,0,0,0
720 GOSUB 935
725 IF W=1 THEN 775
729 REM WALKING LEFT
730 LOCATE X,Y+1,X1
735 LOCATE X+2,Y+1,X2
740 LOCATE X-1,Y+1,X3
741 LOCATE X+1,Y+1,X4
745 IF X1+X2+X3+X4=0 THEN Y=Y+1:GOTO 815
750 LOCATE X-1,Y,XX
755 IF XX=0 THEN X=X-1:GOTO 815
760 LOCATE X,Y-1,XX
765 IF XX=0 THEN Y=Y-1:GOTO 815
770 GOTO 815
772 REM WALKING RIGHT
775 LOCATE X,Y+1,XX
778 LOCATE X+1,Y+1,X1
780 LOCATE X+2,Y+1,X2
785 LOCATE X+3,Y+1,X3
790 IF XX+X1+X2+X3=0 THEN Y=Y+1:GOTO 815
795 LOCATE X+3,Y,XX
800 IF XX=0 THEN X=X+1:GOTO 815
805 LOCATE X,Y-1,XX
810 IF XX=0 THEN Y=Y-1:GOTO 815
815 GOSUB 915
820 IF Y<4 OR X<5 OR X>69 THEN 830
825 NEXT I
830 REM
835 FOR I=5 TO 75:FOR J=5 TO 10
840 LOCATE I,J,XX:IF XX<>0 THEN 850
845 NEXT J:GOTO 275
850 NEXT I
855 FOR Z=1 TO 5
860 FOR Z1=200 TO 80 STEP -7
865 SOUND 0,Z1,10,7
870 SOUND 1,Z1+7,10,7
875 SOUND 2,Z1+14,10,7
880 NEXT Z1:NEXT Z
885 ? "YOU'RE DONE AND TOOK "|DA|" BAYS'"
890 FOR X=0 TO 2:SOUND X,0,0,0:NEXT X
895 ? "PRESS TRIGGER TO PLAY AGAIN"
900 POKE 77,0
905 IF STRIG(0)<>1 THEN RUN
910 GOTO 905
915 COLOR 3:PLOT X,Y:PLOT X+1,Y-1
920 PLOT X+2,Y:PLOT X+1,Y-3
925 PLOT X,Y-2:PLOT X+1,Y-2
930 PLOT X+2,Y-2:RETURN
935 COLOR 0:PLOT X,Y:PLOT X+1,Y-1
940 PLOT X+2,Y:PLOT X+1,Y-3
945 PLOT X,Y-2:PLOT X+1,Y-2
950 PLOT X+2,Y-2:RETURN
```

MICRO EXCHANGE

Continued from page 160

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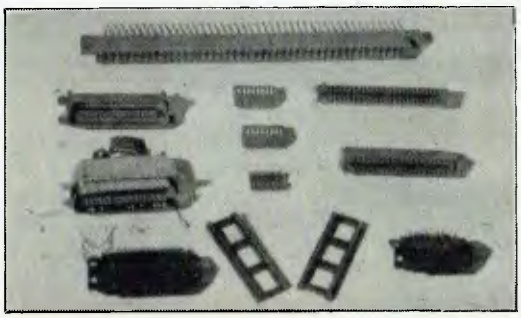

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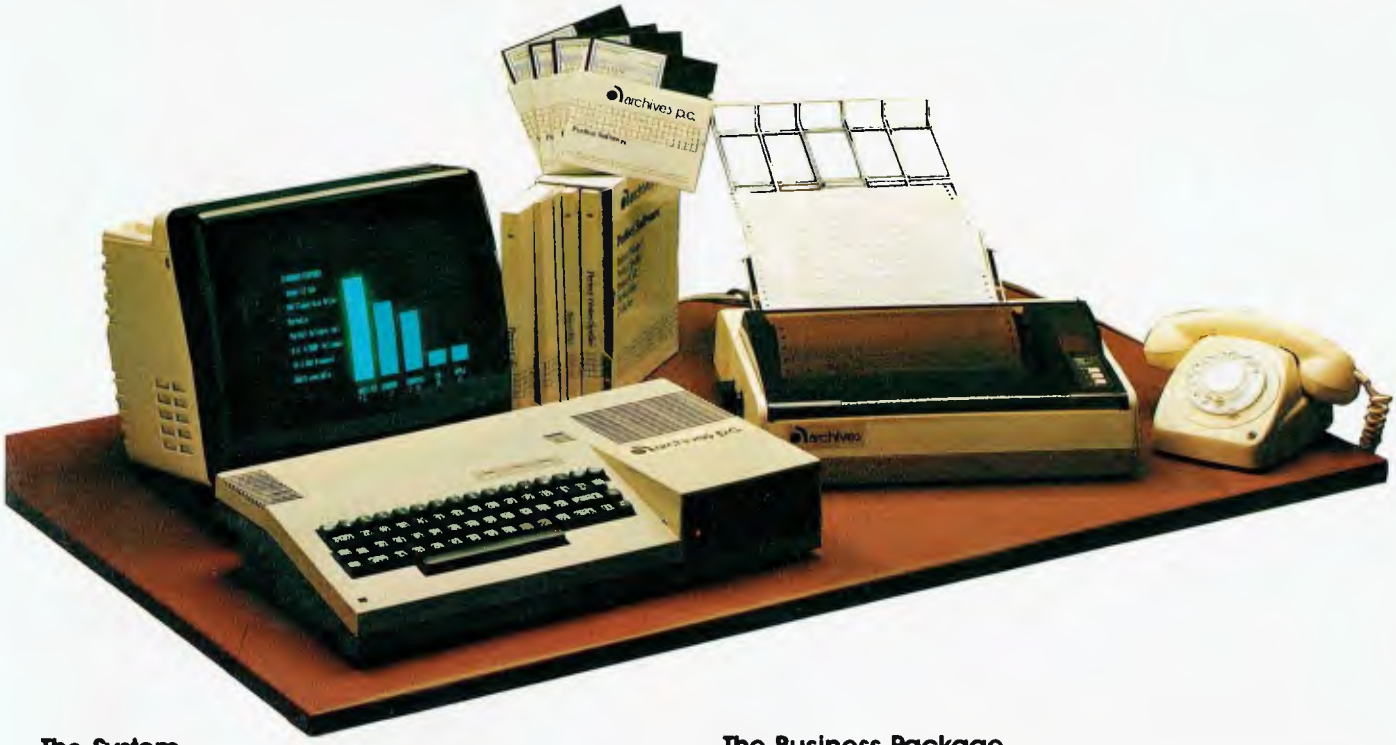

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